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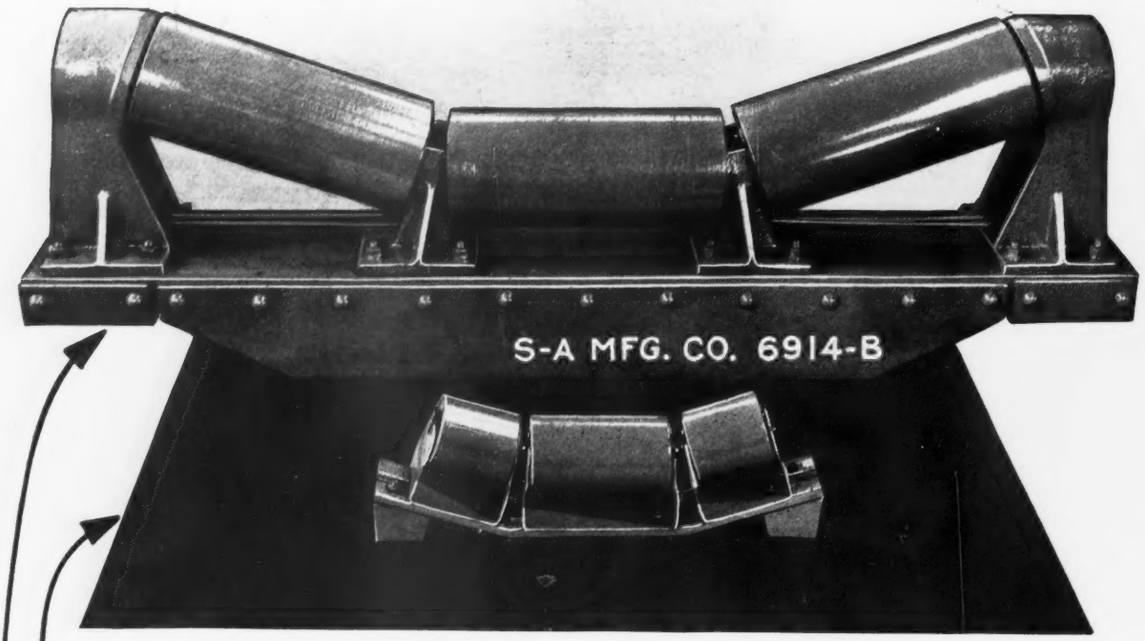
Mining and Other Affairs in London, by T. A. Rickard

United Verde's Drill Shop Practice, by W. P. Goss

Elemental Sulphur in Smelter Gases and Its Elimination, by G. Newton Kirsebom

A New Borate Mineral, by Hoyt S. Gale



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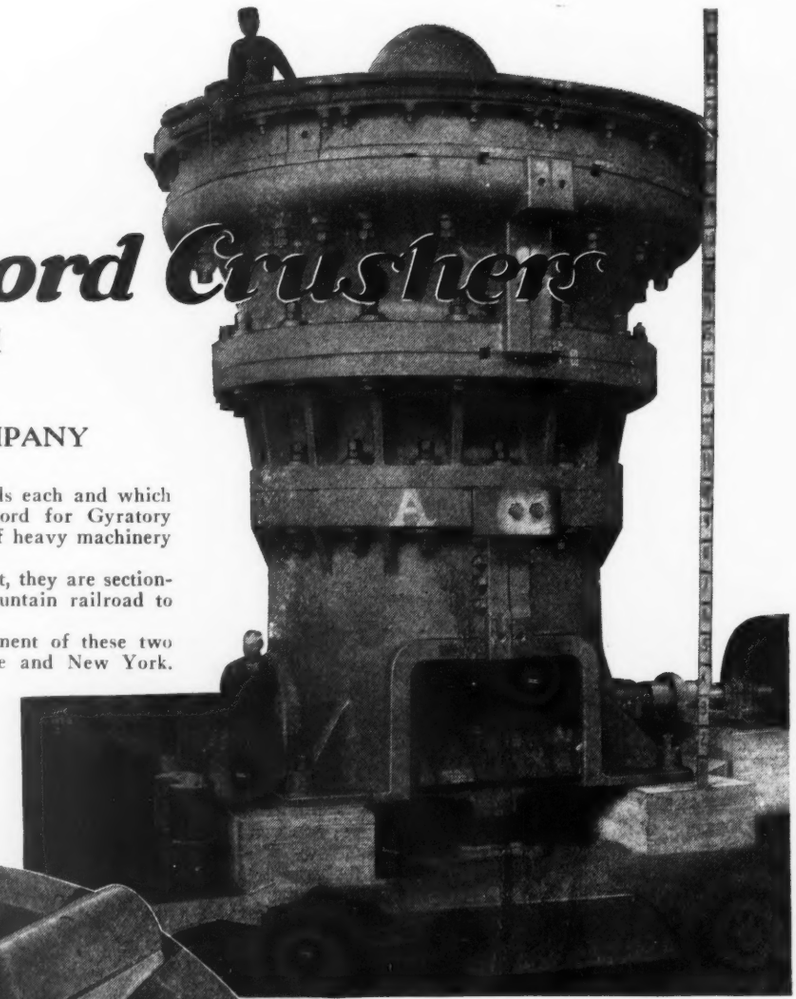

THE two hopper openings, each 5 feet across, permit a carload of ore weighing 70 tons to be dumped into the crusher at one time. Some pieces of the ore will weigh as much as 7 tons. This will be reduced to a 12-inch product. Each crusher handles from 2000 to 2500 tons of ore per hour.

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ENGINEERING AND
MINING JOURNAL

JOSIAH EDWARD SPURR, Editor

Volume 123 New York, January 1, 1927 *Number* 1

Engineering and Mining Journal

Engineering and Mining Journal was founded in 1866 as the *American Journal of Mining*, with George Francis Dawson as Editor. In 1869 the name was changed to *Engineering and Mining Journal.*

Publications which have been absorbed are: 1875, *Coal and Iron Record;* 1877, *The Mining Review* (Denver); 1879, *The Polytechnic Review;* 1902, *Mining and Metallurgy;* 1906, *Mining Magazine;* 1917, *Engineering and Mining World.* The successive editors have been Rossiter W. Raymond, Richard P. Rothwell, Fred Hobart, David T. Day, T. A. Rickard, and W. R. Ingalls. In 1919 J. E. Spurr became Editor.

On April 1, 1922, *Engineering and Mining Journal* was consolidated with *Mining and Scientific Press* as *Engineering and Mining Journal-Press.*

The *Mining and Scientific Press* was established in 1860 as the *Scientific Press.* Three years later "Mining" was added to the title. The successive editors have been Almond D. Hodges, Charles G. Yale, J. F. Holloran, T. A. Rickard, and H. Foster Bain.

On July 1, 1926, the paper reverted to its old name, *Engineering and Mining Journal.*

The staff of the *Engineering and Mining Journal* consists of J. E. Spurr, Editor-in-Chief; T. A. Rickard, Contributing Editor, San Francisco, Calif.; George J. Young, Associate Editor, San Francisco, Calif.; A. H. Hubbell, Managing Editor; E. H. Robie, A. B. Parsons, A. H. Fay, W. N. P. Reed, E. J. Gealy, Assistant Editors.

Mining, Manufacturing, and Marketing

AT THE FORTHCOMING ANNUAL MEETING of the American Institute of Mining and Metallurgical Engineers in New York the usual excursions are planned with the idea of showing the mining engineer—that is to say, the producer—where and how his product is consumed. To that end trips will be made to some of the huge manufacturing establishments which happen to be within easy reach of the center of population, to see the enormous quantities of various metals incorporated into the manufactured form in which the public buys them. With the same idea, a meeting of the New York Section in the spring will be devoted to the display and explanation of a film showing the stages of copper from the mine to the finished product, the story being drawn from the operations of the Anaconda Copper Mining Co., one of the pioneers in putting into practice the principles of marketing of copper, through manufacturing it into purchasable shapes and articles, and selling it directly to the public.

The consumption of copper has greatly increased, and surpasses all records: and while most of this increase must be regarded as due to the insistent demands from a rapidly growing and prospering industrialism, yet part may perhaps be credited to improved methods of marketing and to advertising. Add to this the technical improvements in mining and especially in metallurgy, and in management, whereby the cost of production hovers around the pre-war figure, even though this figure, expressed in cents, corresponds to a real figure (due to the depressed real purchasing power of the dollar) lower than was ever attained in pre-war days. This lowered cost of production permits the offering of the product to the public at such a price as to discourage competition for substitutes.

Marketing problems will continue to be the chief study necessary for all the mining industries—metallic and non-metallic; and more and more mining and manufacturing and marketing will be concentrated under one ownership or at least management. In the non-metallic industries marketing considerations are even more important than in metal mining; freight and transportation are larger and more variable factors, determining whether or not mining can profitably be carried on; standards and brands and preparation are even more important than in the case of metals; and the production of non-metallics must tie in to some favorably localized manufacturing industry which can and will use the mined and prepared product to its advantage. Manufacturers, of course, have sensed this earlier than the miners; and the tendency is widespread for them to acquire and operate their own mines, reversing the process of the Anaconda; Ford is the most striking example of this reversal of policy.

As far as the prosperity of mining is concerned it makes little difference whether the manufacturing industry or the associated mining industry plays the part of the dog which wags the tail, or the reverse: the necessity is for a proper and close co-ordination of mining, manufacturing, and marketing, which will produce from the mines maximum tonnages at the best possible return, and give work to the largest force.

The Solid South

THE "SOLID SOUTH," politically, may soon become the "Independent South" economically. While cotton is and has been King for many years, Birmingham and Atlanta are rising like magic cities, through the fabrication of native materials to meet domestic requirements. These and many other cities are becoming industrial centers that utilize native labor, local natural resources, and coastal markets. Cotton in a major way is the market barometer. The low price of cotton causes talk of the restriction of acreage next year. The cotton farmer cannot prosper so long as he plants all his acreage to cotton and at the same time buys his fruits, vegetables, and meats in local markets that retail imported agricultural products. Diversity of crops is his solution, not government aid.

The mining industry of Birmingham is leading the way to economic independence. In years gone by, local pig iron was shipped to points north of the Ohio River for fabrication and the finished product in turn shipped back to the Southern market. Now the iron ore of

the district provides the iron and steel for local skyscrapers, cotton gins, sugar machinery, stoves and agricultural machinery, all fabricated in adjacent industrial shops. This gives diversity of industry. Pig iron, analogous to cotton as the only farm product, was formerly the sole product of the mines. Industries beget other industries, and many business enterprises are springing up as the result of the iron and coal mine operations in the Birmingham district.

Outside capital was necessary to set the industrial wheels in motion. Now that they are revolving, Southern capital is accumulating and being reinvested in local industries. Coal, iron, clay, abundant water power, agricultural land, phosphate rock, timber and other natural resources, all concurrently exploited and fabricated locally, will provide labor for countless thousands, raise the standard of living, and bring into being a new, prosperous, and economically independent South.

Oil Shale

FOR A NUMBER OF YEARS the mining and reduction of oil shale has been the theme of ignorant boosters and the subject of hopeless stock promotions, enticing money away from the investor. In the meantime, however, genuine research and experimentation has been continually proceeding. The fact always remained that an immense reserve of oil and other hydrocarbon products lay locked up in those sedimentary deposits containing the natural hydrocarbon known as kerogen, the application of heat to which would break it down into a petroleum-like oil and other substances. There is also the petroleum-saturated sandstone and shale, in which the pores of sedimentary rock have served as reservoirs for ordinary liquid petroleum; in this case also the oil is recovered by heating and consequent distillation. In foreign countries, especially in Scotland and in Esthonia, these processes have been and are being profitably applied to oil shale. In the United States, fluid petroleum has been superabundant and therefore cheap; so that the distillation of oil shale has, for economic reasons, not been able to make much progress. This is still the case: there is no reason to believe that the time has yet come when oil-shale industries can prosper widely and on a large scale.

It is, however, most likely that the present superabundance of American and of Mexican oil is transitory; a few years may make a great difference in the supply of naturally flowing oil, and consequently in the price of oil and its derivatives and byproducts. Oil and gasoline will then be forthcoming, but through more expensive channels—the mining and treatment of oil sands, of oil shales, and the heat-treatment of coals and lignites; all these successors to the flowing well will compete with one another and locally with the residual supply of flowing petroleum.

Yet another possible factor will be the purely artificial or synthetic oil and other hydrocarbons, put together out of whatever hydrogen and carbon supplies are best fitted and cheapest. The locality of the supplies with reference to fuel and power, transportation, and markets will locally determine the advantage of one over the others, and give it abundant commercial success.

From any point of view, however, the enormous deposits of oil shale in the western United States and western Canada are economic assets of incalculable value, which will be drawn upon in the future—possibly soon. Oil shale, where favorably situated at the surface, may have one great advantage over oil sands and coal as a source of oil, in that large-scale production may be carried on. Oil shales are richest in oil in certain thin layers, which correspond in dimensions to coal seams, but above and below these rich layers the shale usually contains oil, though of much less content. The future successful large operation will probably be a method of wholesale open-cut mining, with mechanical shovels, and correspondingly vast and hence economically run reduction works. Under the best circumstances, we may expect, some time in the future, to see astonishingly low costs of total production, through this mining and treatment of low-grade oil shales on a large scale.

Signs of the Times

NEWS of the closing down of the Humboldt copper smelter, in Arizona, closely follows reports of capacity production at the Garfield smelter, enlargement and modernization of the Copper Queen smelter, a general increase in world copper production, and bigger dividends for shareholders of the most important companies. A comparison of these facts is significant of what is happening in this industry—increased operations and profits for the big fellows, accompanied by curtailment or cessation of activities by the small companies, who feel keenly the decline in copper prices.

The Humboldt smelter has had rather a checkered career; at no time save at the peak of war prosperity has it been able to pay dividends. It is dependent upon a well-mineralized district, but one in which there are no big mines. Few of the operators of the numerous small mines around Prescott can do much in a 13- or 14-cent copper market; they are obliged to mine only the high-grade ore if they are so lucky as to have any. As a result, the Humboldt smelter is said to have had but 200 tons of ore a day to draw on, and this was about half of what it could smelt efficiently in its reverberatory plant.

Exhaustion of high-grade ore and the almost universal adoption of the flotation process of concentrating copper sulphide ores has caused other than reverberatory smelting to be practically obsolete. A blast furnace can be operated efficiently at small tonnages, but it will not willingly smelt fine concentrates. So reverberatories have to be used unless one wishes to go the roundabout way, and sinter the blast-furnace charge. A modern reverberatory requires from 400 to 800 tons of ore per day for efficient operation, and modern converting equipment should have more than one reverberatory to supply the matte.

Selling a Prospect

ONE OF THE MOST DIFFICULT PROBLEMS in the mining industry is that of bringing together owners and prospective purchasers of undeveloped or partly developed but possibly valuable mining properties. There are hundreds of entirely honest, square-dealing owners of promising prospects who are in search of someone who will buy on bond-

and-option, enter into partnership under an equitable agreement to supply funds, or in some other manner finance the work that is necessary to make a start at determining whether the property is worthless or has a reasonable chance to become a profitable mine.

There are, too, companies and individuals that have money that they can afford to spend in financing such undertakings, and who are anxious to find prospects of merit. *Engineering and Mining Journal* is continually receiving letters from people in the first category—the owners—seeking help in finding those in the second category—the possible buyers. About the only advice that can be given is to consult the officials, first, of established mining companies who are operating in the general vicinity of the property in question; and, second, of the larger exploration companies whose activities are widely diversified as to geographical scope, and to whom consequently the location makes little difference.

In some instances such recommendations have resulted in the financing of operations, but usually the prospect has not been developed to the point where the established company is interested. At the same time there is good reason to believe that there is ample speculative capital to finance preliminary work. There are individuals of means, or small syndicates or companies, that would like to participate in a bona fide attempt to prove up a prospect; and who had much better do that than to toss their money to sure-thing vendors of worthless mining shares. The problem is to put the honest prospect owner in touch with the speculative buyer.

One way that has proved effective in a degree, at least, is the use of space in the "Searchlight" section of the *E. & M. J.* A recent investigation revealed the fact that to eleven such ads, published in the last two months, the number of replies ranged from one to nineteen and averaged more than five. These of course were the so-called "keyed" ads, where the replies are addressed in care of the *E. & M. J.* and are forwarded to the advertiser. It is reasonable to suppose that the ads in which the owner's actual address is printed would get, on the average, a larger return. Naturally, data on this point are not available. Incidentally, a keyed advertisement of a company in the market for a lead mine elicited no fewer than sixty-seven replies.

That some of the answers received were of little or no real value is probable, and the net result on the face of the figures is not particularly encouraging. No one is urged to try this method of obtaining financial aid of this kind, because it is not demonstrated that one would get a fair return for the money spent for the ad. Advertising that does not give results is not desirable. However, the evidence shows that ads of this character are read; and if any owner of an honest prospect wants to try this method, the way is open to him.

Larger and Cheaper Production of Zinc

INDICATIONS may be observed that somewhat the same factors that have been so apparent in the copper industry may also be affecting zinc. In copper, we have had almost record-breaking production, at below pre-war prices, and with most of the companies earning satisfactory and increasing profits: conditions brought about by increased economies in the mining and reduction of copper ores as a result of greater technical skill. Now, in the case of zinc, we have had five successive months in which the production in the United States has been over 50,000 tons, culminating in November, with 55,062 tons, the largest monthly production in recent years and but little if any less than the rate at the peak of war activity. And yet the price has recently been going down; the average for the year will be about a third of a cent less than that for 1925, and at present is only a quarter of a cent more than the average for 1912. Certainly, producers would not be increasing production if they were operating at a constantly lessening margin of profit; so how can present conditions be accounted for?

Without doubt the answer lies, as it does in the copper industry, in improved technology; chiefly, perhaps, in the adoption of selective flotation. Two or three years ago, flotation of any kind was virtually unknown in the Tri-State district; now, the practice in many mills there compares favorably with that at some of the most modern plants in other parts of the world. In the mountain states further west, the complex-ore problem is at least partly solved by the development of selective flotation methods, and zinc that was once a liability in ore is now an asset. Development of hydrometallurgical processes for the production of electrolytic zinc should also be mentioned as having greatly aided in the economical disposition of the flotation concentrate.

So now we may have the spectacle of gradually decreasing zinc prices, coupled with increasing production and greater profits for the miners and smelters. There is no promise that such a change will be sharp, but the trend is beginning to be evident. Somewhat the same conditions have occurred in lead also, though the demand for lead has been so enormous, owing to expanded use in the electrical industries, that the supply of ore has not been so plentiful, and prices have remained far above pre-war levels.

European Superphosphate Trust

IN THE CURRENT NEWS of the day is a report of the formation of a general superphosphate trust which includes various European countries, French, North Africa, and British South Africa. The organization proposes to prosecute research and study of the phosphoric acid and superphosphate business, with relation to substitute fertilizer materials and synthetic fertilizers said to have been invented by German interests. Such an organization is symptomatic of the times. Protection of raw material markets and their expansion is now apparently essential in many lines and is a fundamental, modern phase of agriculture. The independent private operator, be he farmer or producer of raw fertilizer materials, is at a disadvantage when it is necessary to compete against an organized business. Such is the status of a number of non-metallic products. Expense for research, if undertaken by an independent producer, is not justified unless he can secure adequate protection for his novelties, which is not always the case. It is therefore beneficial to combine with other producers and share the expense for research, development of new uses, and the securing of marketing information. The general superphosphate trust, referred to before, is merely another manifestation of the principle described.

United Verde's Drill-Shop Practice

Systematic Handling, Forging, and Tempering Cut Mining Costs—Careful Testing Is Feature

By W. P. Goss
Chief Efficiency Engineer, United Verde Copper Co.

THE COST OF DRILL STEEL, and its preparation and handling, are large items in many mines, especially where the rock that is drilled is hard and abrasive. It is only by careful choosing, sharpening, transferring, and inspecting of the steel that the cost may be kept at a minimum.

At the United Verde Copper Co.'s mine the organization for the handling of drill steel consists of a steel foreman, who has charge of all blacksmith work; a jigger boss, who has charge of the drill sharpening and hardening; seven drill sharpeners and their seven helpers; four heat treaters and two helpers; three roustabouts who sort the steel, move it about in the shops, dress the shanks, and straighten bent steel; and a head nipper and three helpers who route the steel in and out of the mine.

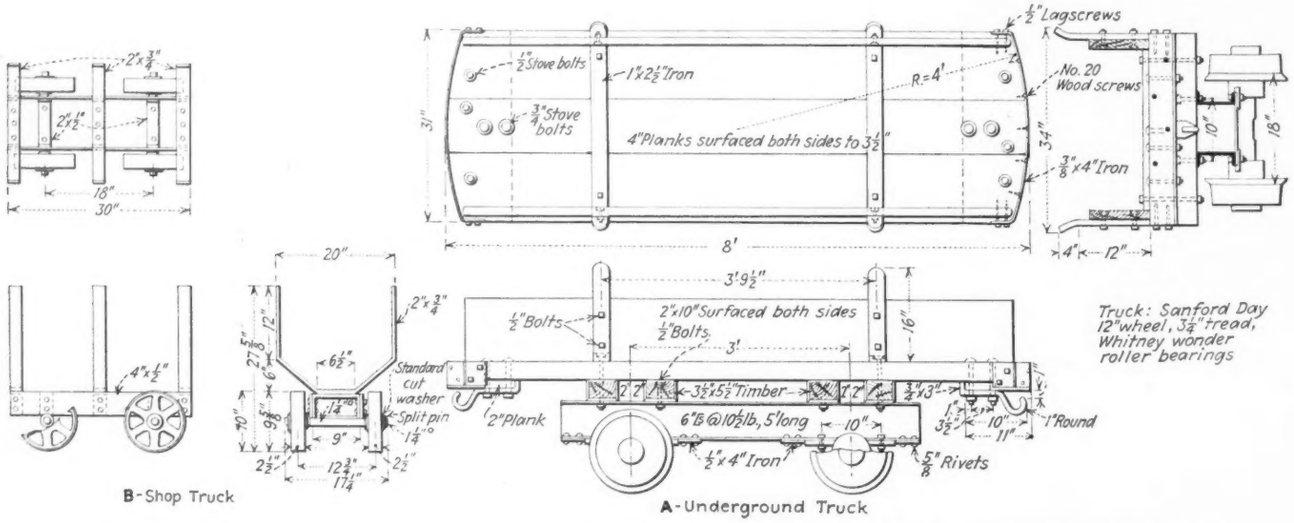


Fig. 1—Details of trucks for handling drill steel (A) in the mine and (B) in the sharpening shop

Routing of Steel Important

The arrangement of equipment was designed to minimize handling and to facilitate the easy flow of steel through the shop. Trucks of dull steel brought out of the mine are left standing on the track between the rows of sharpeners each morning. Roustabouts sort this steel according to length and section, placing it in racks at the left-hand end of the furnace in which it is to be heated. The cold steel goes into the left of the furnace and the hot steel comes out at the right. Then it is punched and placed in the sharpener. After the steel is sharpened, it is placed in a shop truck to the right of the operator. When one of these trucks is filled, it is moved by a roustabout to the heat-treating machine and an empty truck is wheeled in to its place. The steel coming from the heat-treating machine is inspected and placed in a revolving rack if it passes inspection. Defective steel is put in a shop truck to one side. This revolving rack is near the central track, so that the nippers can readily transfer the finished steel from the racks to the mine trucks. Fig. 1 shows the important details of the two kinds of trucks.

A No. 8 Waugh sharpener is used for shanking the steel. After the shank is formed, the steel is put in a shop truck and wheeled to a furnace. Here the end of the shank is heated for about two inches and the hole is countersunk with a hand punch. The steel is then taken to a grinder, where the face of the shank is ground smooth and the edges are chamfered. From here it goes to the hardening furnace, where the shank is heated and then quenched in an oil bath. This bath is near the central track and is large enough to serve as a rack for finished steel which awaits the nippers.

Nippers fill their orders for the mine from the revolving racks and the oil-quenching tank. Any surplus steel is placed in storage racks outside the shops. The head nipper goes underground each morning and inspects the underground storage racks, making out a list of steel required for each level. This steel is loaded into mine trucks during the day and is taken underground and distributed by two nippers on graveyard shift. The dull steel is brought out of the mine by these same men. Miscellaneous tools and rock drills go in and out of the mine on the trucks with the steel.

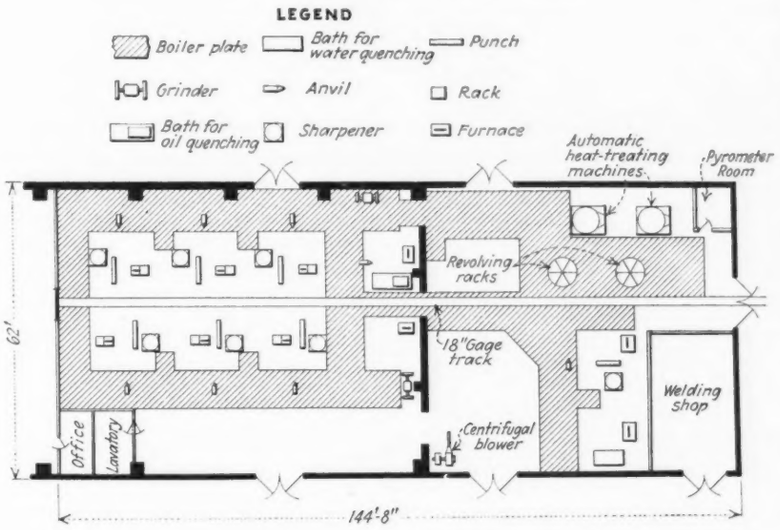
Boiler-Plate Floors

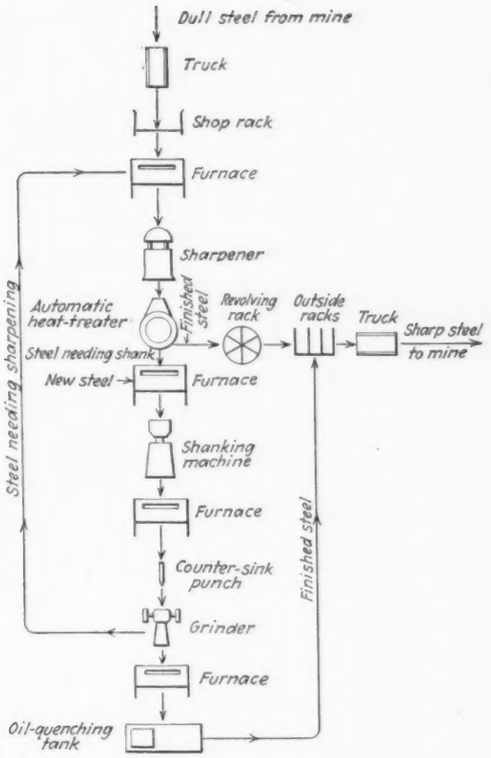
The floor of the shop is concrete, overlaid with boiler plate, so that the small shop-trucks can be wheeled about easily wherever desired. A track from the mine runs past the outside storage racks and into the shop. An overhead crane, serving several shops in the same build-

ing, makes it possible for all heavy equipment such as sharpeners or furnaces to be moved and placed easily. The accompanying floor plan, Fig. 2, and the flow sheet, Fig. 3, will help to clarify the above explanation.

The forging furnace, shown in Fig. 4, is a home-made product which gives very satisfactory service. The

Fig. 2—Floor plan of shop, showing the arrangement of equipment. Fig. 3—Flow sheet, showing course of steel through the shop





capacity of this furnace is approximately 500 pieces of 1¼-in. hollow round drill steel, heated from 60 deg. F. to 2,000 deg. F., per eight-hour shift. The oil consumed is 3 gal. per hour. A semi-Diesel fuel oil, gravity 24 deg. Baumé, is used. Air for atomizing and burning the oil is furnished at 1.25 lb. pressure by a centrifugal blower. The air line from the centrifugal blower is cross-connected at each furnace with an air line from the mine compressors, so that two sources of air are available in case of need. The atomizer or burner used is a Gilbert & Barker 1½-in., single-jet burner with special air orifice. Oil is fed to the furnaces from a 450-gal. storage tank. Compressed air at 90 lb. furnishes the "head" to the oil. This tank is pumped full each day from a 16,500-gal. tank buried near the shop.

Each furnace is equipped with a Brown, Model 101-1 pyrometer with wooden protecting case and type MA thermocouple, ⅛ by 12 in., with nickel-chromium protecting tube. These pyrometers are held up by a ½ by 3-in. iron strap bolted to the back of the furnace. The thermocouple is inserted through a hole in the brick at the right-hand end of the furnace, so that the end of the couple is close to the hot steel. The temperature indicated by the pyrometer is the temperature of only a small per cent of the furnace gases immediately surrounding the hot junction of the thermocouple. In a well-regulated furnace, this temperature may be indicative of the average temperature throughout the furnace and of the temperature of the steel left in the furnace for a given length of time. If the burner is set so that the heat is concentrated at the end containing the thermocouple, then the pyrometer will indicate the maximum temperature to which the steel can be heated. With fairly constant conditions in the furnace, and when the steel is passing through the furnace at a uniform rate, the temperature of the steel can be maintained at a given point. This point will depend upon the temperature of the furnace and the length of time the steel is in the furnace.

Punched and Forged With One Heat

It has been found at the United Verde that, with the maximum temperature of 2,000 deg. F. at the hot end of the furnace, a piece of steel taking twelve minutes to pass from the cold to the hot end of the furnace will reach a temperature of 1,900 deg. F. This temperature will allow the bit to be punched readily and forged without reheating. The work of forging the bit refines the coarse grain which the steel acquires at 1,900 deg. F. An attempt to start forging at a lower temperature than 1,900 deg. F. will make punching difficult and result in the temperature dropping below the critical range before hammering can be completed from one heat.

A 5-in. pipe in front of and above each furnace opening serves as a baffle to protect the operator from the furnace heat. Water is constantly flowing through this pipe to keep it cool. This water is in a closed circuit with the water used in the Gilman heat-treating machines and the cooling water for the compressors. A ¾-in. pipe with ⅛-in. holes spaced ½ in. apart lies on the hearth in front of the furnace opening. Compressed air coming from the holes in this pipe deflects the hot furnace gases up between the furnace and the 5-in. pipe baffle. As this air passes up between the pieces of steel in the furnace, it tends to keep the steel cool beyond the bit.

To keep the furnace operating properly, it is necessary that the combustion chamber be kept clean and the action of the flame carefully watched. An opening is left in one end of the furnace near the bottom so that accumulations of unburned carbon and other foreign

matter may be removed easily. The burner is mounted at the back of the furnace on adjustable brackets so that it can be shifted slightly in any direction, thus controlling the direction of the flame. A slotted piece of tin which can be slid back and forth in front of the burner gives further control of the flame.

Pyrometers on Furnaces

The use of pyrometers with the forging furnace has two marked advantages: first, the product is uniform in temperature and is kept at a minimum temperature; second, the life of the furnace is greatly prolonged, due to the lower temperature maintained.

Six No. 5 Ingersoll-Rand sharpeners are used for sharpening and forging bits. The dollies, dies, and formers are made in the mine machine shop for 50 per cent of the factory price. The output per sharpener averages about 375 pieces of steel sharpened per eight-hour shift, and the shop output is about 2,100 pieces of steel per shift. All the shanks are made on a No. 8 Waugh sharpener which has a capacity of about 250 shanks on 1¼-in. round steel and 350 shanks on ⅞-in. quarter-octagon steel per shift. Punches made in the United Verde shops are used with all the sharpeners because they have been found superior to the factory product.

The bit formed is a double taper 4-point cross bit with 5- and 14-deg. taper angles. For a 10-in. change in length, the gage change is $\frac{1}{16}$ in., and, by skipping every other length, a 20-in. change in length for a ⅛-in. change in gage is secured. This arrangement proves very advantageous at this property, for the short change is necessary for drilling hard, abrasive rock, and the long change is useful for drilling the softer rock. The steel used is 1¼-in. hollow round with lugged shanks in drifter type machines, and ⅞-in. hollow quarter octagon in stopers and jackhammers. The stoper steel has a plain shank and the jackhammer steel a collared shank.

The bits on all the mine steel at the United Verde mine are hardened in Gilman CE-21 heat-treating machines. It costs this company about $0.0035 per bit more to treat steel on these machines than it does to treat steel by hand and eye, but its engineers believe that this cost is justified by the more uniform product obtained from the machines. The total cost of sharpening and hardening is lessened, for fewer pieces of steel will be dulled in a given amount of drilling. No definite figures are available on what the Gilman machines have saved, because the use of the machines was introduced gradually and at a time when changes were being made in the forging practice and in the brand of steel used.

Three men are employed to operate the two machines:

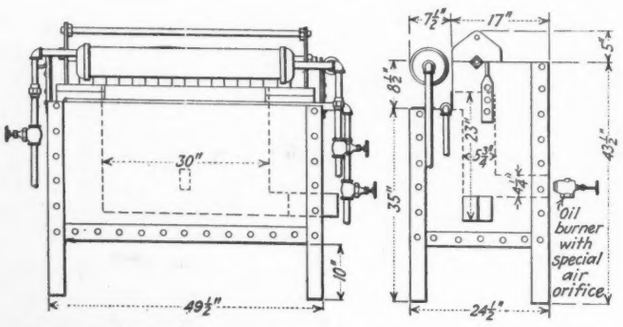
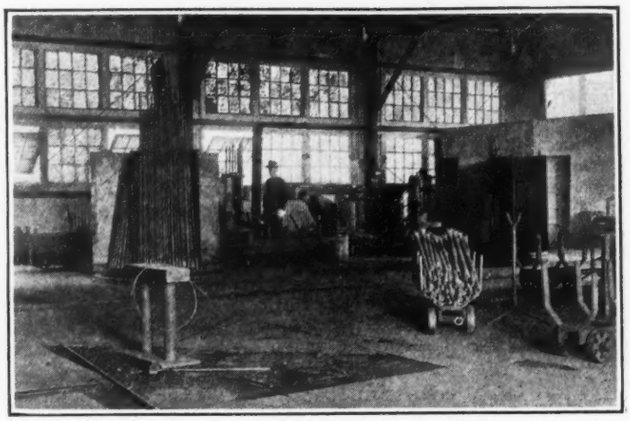


Fig. 4—Sketch showing main features of furnace for heating drills



Heat-treating machines and revolving racks

one man on each machine to handle the steel, and the third man to watch the furnaces and pyrometers and to help out whenever needed. The furnaces are hand-controlled, because they were bought before the automatic control had been perfected.

Two Thermocouples on Tempering Machine

It was found impossible to obtain steel of a constant temperature from the Gilman machine with a single thermocouple in the furnace. By placing a thermocouple in each end of the furnace, and keeping the fire regulated so that both couples are at the same temperature, the temperature throughout the length of the furnace will be reasonably uniform. As is stated in the directions for the operation of the heat-treating machine, a uniform temperature throughout the length of the furnace is absolutely necessary if reliable results are to be obtained. However, the size and shape of the furnace make this a difficult condition with which to comply, and it is only by careful manipulation of the burner that a uniform temperature can be obtained and maintained. The furnace tends to heat up unevenly for about 2½ hours after it is started, so that constant attention is necessary during this period. Ventilation in the building may alter during the day, or foreign material may collect in the furnace, thus changing conditions within the furnace.

The two furnaces on the two Gilman heat-treating machines here seem to be identical, but the steel coming from one is 40 deg. hotter than the steel coming from the other when both machines are run at the same speed and the pyrometers record the same temperatures for both furnaces. This difference is compensated for by the operating of one furnace at a temperature 40 deg. higher than the other.

By experiment it was discovered that a bit quenched at 1,400 deg. F. from the heat-treating machine would "stand up" best in our hardest rock. Therefore, to obtain steel from each furnace at this temperature, a temperature of 1,480 deg. F. is maintained at the couples in one furnace, and a temperature of 1,520 deg. F. is maintained at the couples of the other. The speed of the machine is varied according to the gage and section of the steel being treated. Speed and temperature used at this property may or may not be correct for any other installation, for so many variables enter into the conditions of operation at different properties that each operator must discover the speed and temperature best suited to his particular requirements.

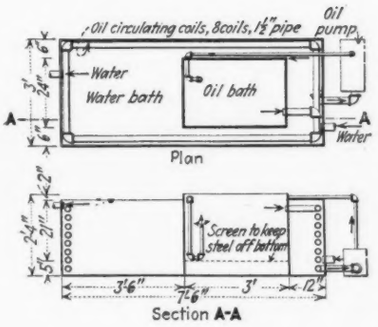


Fig. 5—Sketch showing quenching tanks

Bits hardened on these machines by the method described above will have a hardness of about 625 to 650 points Brinell. They will be tough enough to prevent chipping or breaking and will give a maximum of service in jasper or dense, fine-grained pyritic rocks. Probably it would be possible to make a better bit than the above by quenching at 1,450 deg. F. and then drawing to a temperature set by experiment, but this would entail an excessive tempering cost.

All shanks are hardened by hand and eye. The furnace for this purpose is similar to the one used in heating for forging. An 18-in. thermocouple is placed in this furnace parallel to the steel, so that the shank ready to be quenched is next to the couple. The operator thus has a standard "color" with which to compare the color of the shank. This method is superior to any which requires that the steel be removed from the furnace for comparison with a standard "color" or for testing its attraction for a magnet. When the steel is removed from the furnace for its temperature to be checked, the tendency is to heat the steel above the point desired and then allow it to cool before quenching.

The shanks are heated to 1,800 deg. F. and quenched in Houghton's No. 2 soluble quenching oil. This oil is kept cool by circulation through coils immersed in cold water, as shown in Fig. 5. The oil is kept below 120 deg. F. and the cooling water does not raise above 75 deg. F. The oil tank is arranged so that the hot shank can be placed in a jet of cool oil coming from the coils. Once a month the oil is pumped out of the tank and the tank is cleaned.

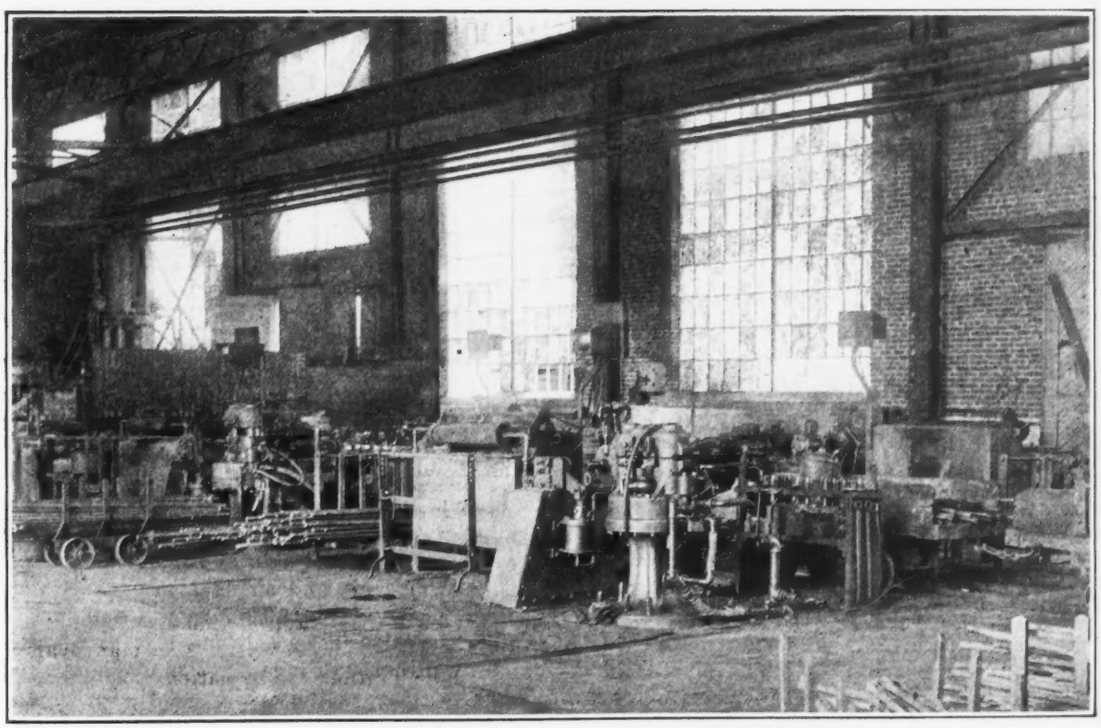
Experiments are now being conducted to find out if a lower temperature than 1,800 deg. F. will make a better shank. So far operations show that shanks quenched at 1,500 deg. are a little too weak. They have the same Brinell hardness at the surface as shanks quenched at 1,800 deg. F., but they upset and spall off when put in service. The Brinell hardness of the face of shanks quenched at 1,800 deg. F. is from 375 to 400. No trouble arises from shanks on 1¼-in. hollow round steel, but the shanks on the ⅞-in. quarter octagon steel give trouble when drilling very hard rock. This is due to the small area of the striking face of the shank.

Before the steel is hardened the hole is countersunk with a hand punch, the face is ground, and the edges are chamfered. This squares up the face and allows for a small amount of upsetting when the steel is first put into service. The lugs or collar and face are "dressed" on the emery wheel whenever they show need for it after the steel has been used.

Close Inspection of Shanks

Steel coming from the Gilman heat-treating machine is inspected by the operator of the machine. If it is crooked or if the shank is imperfect, it is laid aside. This defective steel is turned over to a crew, who straighten the crooked steel, re-dress the shanks, and put aside for re-shanking any steel which has broken, chipped, or upset shanks. Badly bent steel is heated and straightened hot under an air hammer.

Bits and shanks are tested at regular intervals for hardness on a Brinell machine of the improved American model, and, if they are found to be too soft or



End of Sharpening shop, showing forging furnaces and sharpeners

too hard, the pyrometer equipment is checked at once. The pyrometers and thermocouples are checked regularly with an instrument and couple kept for that purpose. This secondary standard set is the same as is used on the various furnaces, and it is checked against a

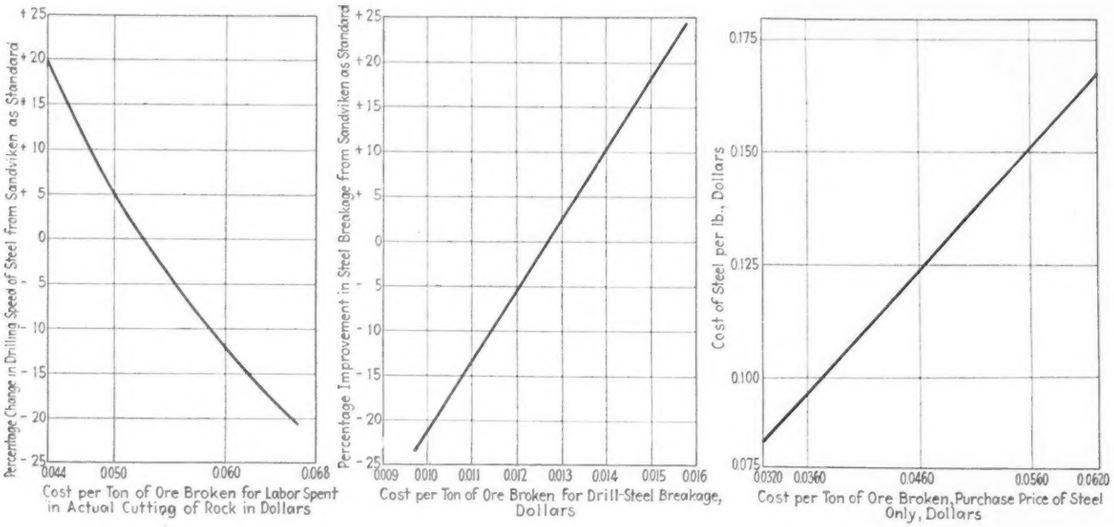


Fig. 6—Curves showing relation of various factors to the cost per ton of ore broken

potentiometer and standard platinum thermocouple. A small electric muffle furnace is used for testing the thermocouple, because it furnishes a constant temperature which can be easily controlled. Each couple is tested and each pyrometer is checked when it arrives from the factory. Thermocouples used give accurate results up to the time they are burned through. Pyrometers remain accurate as long as they are not subjected to great and sudden changes in temperature. They must be checked frequently to insure accuracy.

The real test for drill steel is the service it gives. The practice at the United Verde mine is to test the steel by putting it into service as well as testing it in the laboratory. Take, for example, the determination of the correct quenching point for shanks. Twenty to forty pieces of new steel are made up and quenched at a given temperature. Each piece is numbered, so that individual records can be kept. The steel is used, re-sharpened, and re-used until it has failed. The distance drilled and the time required is noted, so that the work accomplished by each piece is known and may be compared with the work done by a piece which received a different treatment.

Carbon Content from 0.80 to 0.85 per Cent

The United Verde company attempts to purchase drill steel that will prove the cheapest over a period of time. Four bars of each section of steel that it uses are purchased from the various steel companies for trial and test. A 4-ft. sample is cut from each bar and run to destruction against an iron block. The rest of the steel is made up into three sets of each section and run to destruction underground. Gage wear, depth of penetration, and drilling speed are noted for each piece of steel. Everything possible is done to insure that all the steel receives the same treatment. A set of curves is made up which evaluates drilling speed, breakage, and first cost in terms of dollars per ton of ore mined at this property. See Fig. 6. Ingersoll-Rand Sandviken steel is taken as a standard, because the company has used this steel for several years and has accurate data on its performance, life, and cost. A carbon drill steel with a carbon content of 0.80 to 0.85 per cent is the only kind considered in tests, because such a large tonnage of this type of steel is in circulation that it would be practically impossible to keep a special alloy steel separate from the carbon steel. This would mean that one or the other steel would receive the wrong heat treatment and thus offset any good which might arise from using the special alloy steel. Results obtained by using special steels at other properties do not warrant the loss the United Verde would sustain if that company discarded its carbon steel in favor of a special steel.

Drill-Steel Costs and Consumption

Drill-steel consumption	
Total tons per year	140
Pounds per ton of ore mined	0.215

Drill-steel costs	Per Piece of Steel	Per Ton Ore Mined
Nipping	$0.009	$0.004
Labor (sharpening, hardening)	.063	.031
Oil	.006	.003
Air	.017	.008
Repairs	.040	.020
Miscellaneous supplies	.005	.002
Total	$0.140	$0.068

Hardening the bits and shanks is generally considered the most important step in the preparation of drill steel for use. If the steel does not "stand up" as the mine foreman expects it to, the man doing the hardening is immediately blamed. Whenever a revision in shop practice is undertaken, the work starts with the hardening, and automatic machines, salt baths, lead baths, electric furnaces, pyrometer control, or some other device is installed to improve the condition of the steel by improving the process of hardening. This is all very well provided all the care possible has been taken to insure that a good bit and shank goes to the hardener, but all the care and skill of a master workman cannot make a good bit and shank if they have been ruined before he gets them. The blame for poor steel should fall where it is deserved, and this can be determined only by a thorough investigation. When an attempt is made to improve the quality of the product from the drill-steel shop, the initial step should be the proper choosing of the brand and section of steel most suitable

for the work to be done. Then each step in the process should be taken up and perfected in order. The heating for forging and the forging should be perfected before the hardening or tempering is considered.

A poor quality of steel will give poor results. If the steel is burned in the forging furnace, if it is forged at two low a temperature, or if the bit is imperfect in shape, the hardening will not right the wrong and the steel will fail. The hardening or tempering of the bit should not be blamed for its failure until it is ascertained where the fault lies.

The hardness of the bit should depend to a certain extent upon the character of the rock to be drilled. A bit properly forged and carefully heated to just above the critical range and then quenched in cold water will have the maximum hardness obtainable combined with toughness. If drill steel containing approximately 0.80 per cent carbon is quenched at 1,450 deg. F. on a "rising heat," it will be too brittle for some of the hardest rocks, such as solid quartz, jasper, or quartz mixed with pyrite. If this steel is quenched at 1,400 deg. F., it will be a little softer and tougher than when quenched at 1,450 deg. F., and it will drill the hardest of rocks without chipping or upsetting.

Manufacturers of rock drills send out literature telling how drill steel should be made up and hardened. They give temperatures, hardness numbers, and dimensions. It pays us to determine by experiment what is best suited to conditions rather than accept such instructions as gospel. When pistons fail in a drill, the manufacturer is likely to lay the blame on defective drill-steel shanks. Perhaps the fault does lie in the shank, but a bad piston may chip or cup on the face and then chip or upset a shank, so that to all appearances the shank caused the trouble. Whenever shanks or pistons, or both, are not giving satisfactory service it is best to determine the hardness of both piston and shank on the Brinell machine and attempt to lay the blame where it belongs. If the fault is in the piston, the manufacturer is notified, and if the fault is in the shank, the blacksmith foreman is notified. This practice has resulted in obtaining satisfactory steel from the shops of the United Verde Copper Co. and satisfactory pistons from the drill manufacturer.

To Weld Manganese Steel

Manganese steel contains about 12 to 16 per cent of manganese and from 1 to 1½ per cent carbon. There are other minor metallic constituents also, in about the same proportions as in ordinary carbon steel, but these are relatively unimportant in their effect on the properties of the metal and do not affect welding in any way, according to *Oxy-Acetelyne Tips*.

The fact that some of the desired properties of this metal are the result of heat treatment makes the welding problem a difficult one. Added to this is the fact that the high temperatures involved in welding also tend to change the chemical and physical nature of the metal slightly. Though a second heat treatment will restore the original properties in the main casting, it is sometimes difficult to correct structural changes in the narrow zone at the juncture of the weld metal and base metal.

Though it is considered that the welding of manganese steel is not yet fully developed, and though experimental work is still being done on this metal, certain practices have given satisfactory results. It is obvious that smaller castings will respond more satisfactorily to welding and subsequent heat treatment under ordinary shop conditions than larger and bulkier castings, because it is easier to heat uniformly and quench rapidly the smaller castings than those of greater bulk.

To prepare a casting for welding, the edges should be beveled to a 90-deg. total vee. This work can be done only by grinding or by cutting with the oxy-acetylene blowpipe. If the latter method is used, it is recommended that the edges be ground or pickled to remove adhering oxide.

Welding should be preceded by pre-heating, handled in about the same way as ordinary cast iron. Larger castings should be heated slowly in a charcoal-fired pre-heating furnace made of bricks; for small castings a kerosene pre-heating burner or even the welding blowpipe can be used. Manganese steel is quite brittle when red hot, so castings should be carefully supported during pre-heating and welding. Castings should be welded in the pre-heating furnace and protected from drafts or sudden chilling while hot.

Special manganese steel welding rods should be used. These are procurable from the larger manufacturers of welding supplies. The blowpipe flame should be adjusted to show a slight excess of acetylene. Some very satisfactory work has been carried on with an excess acetylene flame showing an excess cone about three times as long as the inner cone.

It is essential that a comparatively large tip or welding head be used and that a large pool of melted metal be maintained at all times. The welding rod must not be rubbed in the weld, but must be held under the surface of the molten pool and the flame applied to melt the rod in the pool of molten metal. When the level of the pool is high enough, it can be melted into the base metal by directing the flame around the edges until the weld metal and the base metal flow together through their own fluidity. Avoid, however, getting such a big pool that it spills over on solid metal, because this makes an "adhesion" with no bond.

After welding is completed, the entire casting should be reheated to a bright yellow-red, or about 1,250 deg. F., maintained at this temperature for about 30 minutes, and then quenched in tepid water. It has been found that by far the best results are obtained by dropping the entire casting in a large vessel of water. It is not sufficient simply to pour water on the heated metal. A sound weld made under these conditions will give satisfactory results where an unusual amount of strength in the welded part is not required.

Manganese Steel Welding Table

	Oxweld Type W-1		Prest-O-Weld Type W-101		
Thickness of Steel, Inch	Welding Head	Oxygen Pressure, Lb. Per Sq. In.	Tip Size	Oxygen Pressure, Lb. Per Sq. In.	Acetylene Pressure, Lb. Per Sq. In.
1/16	6	14	7	2	2
1/8	7	16	8	3	3
1/4	8	19	9	3	3
1/2	10	21	10	4	4
3/4	12	25	11	6	6
1 and over	15	30	12	10	10

A New Borate Mineral

By Hoyt S. Gale

Another new borate mineral has been found in California. It is a clear, colorless mineral of composition like borax except that it contains less water of crystallization. It is the best commercial boron mineral yet found, because a pound of it will yield 1.39 lb. of borax, and all that is necessary to produce borax from it is to dissolve the new mineral in water and let it recrystallize. This is the statement of W. T. Schaller, of the U. S. Geological Survey, who has made careful examination and analysis of the new mineral and pronounces its composition to be $Na_2B_4O_7 4H_2O$. The name proposed is kernite, after Kern County.

The new mineral was discovered in exploratory borings in the northern half of Sec. 24, T. 11 N., R. 8 W., Kern County, Calif., in the Kramer district, which was discussed in a paper presented by Hoyt S. Gale for the February, 1926, meeting of the A.I.M.E., and published in the *Transactions* of that society. According to unconfirmed reports kernite is said to occur in a massive ledge 75 ft. thick, and in very pure form, to judge by material which has been shipped as a result of opening of an exploratory shaft. It has been penetrated in a series of prospect holes, so that the deposit is considered proved over an area of twenty acres. The ledge is, however, understood to have a steep dip to the south.

The deposit gives some promise of having an influence in the borax industry, chiefly to the extent of displacing the production of colemanite. It is even possible that this may be the means of closing or largely reducing production from the mines of the famous Death Valley region, if the deposit shall prove extensive enough.

Searles Lake Production Increasing

Interesting as this announcement is, it serves to call attention also to the ever-changing phases of the borax industry where other and possibly more powerful factors are already on the point of revolutionizing the older-established order of production. One may visualize the situation in a general way by assuming a world consumption of around 125,000 tons of borax and 10,000 tons of boric acid yearly. Of this, approximately 60,000 to 70,000 tons is used in the United States. Until lately the source of domestic production of borax in the United States has been almost wholly the mineral colemanite. Lately, however, a new and growing factor has entered the field in the production of a very high-grade borax made direct in a very efficient way from the brines at Searles Lake, California. For several years now the Searles Lake production has yielded from 12,000 to 15,000 tons of refined borax annually. It is promised that early in 1927 production from this source is to be stepped up by setting in operation new refining units there, so that the yield from Searles Lake alone will be at once increased to 40,000 tons yearly. Thus fully half of the regular consumption will be provided from Searles Lake alone.

Colemanite will undoubtedly always be in good demand, even though new and cheaper sources of borax are now being developed. In the meantime the price of borax has dropped to 4c. and reports are that even that price is being shaded. What will take place in the market when new and cheaper supplies in large quantity are offered remains to be seen.

New Turbines Supply Power and Process Steam

A combination of three extraction-type turbine generators for generating power and meeting a complicated demand for process steam will be installed by the Raritan Copper Works at Perth Amboy, N. J. Power is principally required either at a value of 5,500 or 9,800 kw. Process steam is required, in varying quantities, at 6 lb. absolute and at 2 lb., 30 lb. and 165 lb. gage pressure. The main steam supply is generated at 365 lb. and 200 deg. superheat, and steam at 165 lb. in varying quantities is available from waste-heat boilers.

Three General Electric turbines driving alternating-current generators of the same make will be installed. These will be driven by the steam at 365 lb. One will be a 2,970-kw. low-vacuum unit whose exhaust supplies the needed process steam at 6 lb. absolute. The remaining units will be identical and rated 4,750 kw. each. Each of these will be designed for extraction of the required 2-lb. and 30-lb. process steam, and for either automatic-extraction or mixed-pressure operation at 165 lb. gage.

The process steam required at 165 lb. gage will be supplied from the waste-heat boilers. When these process steam requirements are less than the supply from the boilers the 4,750-kw. turbines will operate as mixed-pressure units, to use up the excess. When the steam supply from the waste-heat boilers is less than the demand, the remainder will be extracted from the same turbines.

Inasmuch as the process steam used in the plant is contaminated and therefore cannot be condensed and used again, the bulk of the boiler feed water will be cold water, the temperature ranging between 40 and 60 deg. F. This water will be heated in three stages by extraction steam from the turbines. As a protection against extreme or emergency conditions, the 2,970-kw. turbine will be arranged for automatic extraction of process steam at 2 lb. gage.

In operation, the 2,970-kw. unit and one of the 4,750-kw. units will be used together to supply the 5,500-kw. load. When the demand goes up to 9,800 kw., all three units will be operated.

The over-all efficiency of the turbines is indicated by the fact that, when the electrical load is 5,500 kw., the heat consumption chargeable to power generation is but 4,430 B.t.u. per kilowatt-hour.

Only Two Arizona Asbestos Mines Producing

But two mines in Arizona are producing asbestos on a large scale, the Johns-Manville mine and the Regal mine, according to E. Schaaf-Regalman in *Asbestos* for December. At the former the bulk of production is Crude No. 2 and goes exclusively to the Manville plants, none entering the general market.

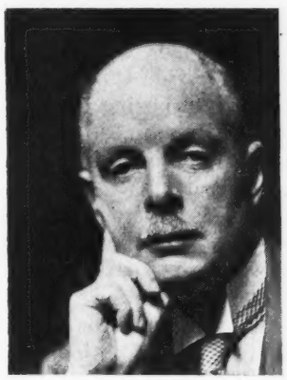
At the Regal mine, production has been increased, the physical condition of the mine being excellent, owing to the systematic development work that has been going on for many years. As far as can be ascertained, the Regal mine is the richest mine in the production of Crude Nos. 1 and 2 per ton of rock mined.

Other asbestos properties in Arizona are producing little or no asbestos at present, but are confining their operations to development work, the lack of transportation facilities and the need of cheap power still being great handicaps.

Mining, and Other Affairs, in London

The "City" Echoes News of Gold, Tin, and Copper From the Colonies

By T. A. Rickard



T. A. Rickard

LONDON continues to be the world's metropolis, the largest community of white people and the chief center of international politics. As a financial center it has lost its pre-eminence, more particularly as regards mining enterprises; but it is still, in many respects, the most interesting of all cities in its capacity to entertain the frivolous, the studious, and the acquisitive. It seemed to me that I noted an improvement in the outward aspect of the people in the streets since my visit last year; a look of increased cheerfulness and a happier determination could be detected in the faces of His Majesty's subjects; the suggestion of weariness, and even of shabbiness, was lacking; there were still too many crippled soldiers engaged in selling pencils or producing mournful music for chance pennies, but the business men in the City no less than the strollers in the West End were better dressed; indeed, during the days of the Eton-Harrow and Oxford-Cambridge cricket matches the sartorial splendor of the young men and their accompanying fluffy maidens was a joyous sight to the visitor from overseas. Speaking of cricket, one is impressed by the excessive attention given to sport; the test matches between the English and Australian elevens were watched with enormous interest; enthusiasts would camp outside the cricket grounds all night so as to secure a good seat on the following day, the description of the matches occupied the chief place in the newspapers, and the favorable result of the final "test" was heralded as a sign of Britain's restoration to vigorous manhood! Horse racing, and the betting that goes with it, engages the gambling spirit of high and low alike; until 6 o'clock the newspapers give nothing but forecasts and results of the races. "Four o'clock winners!" shouts the newsboy, whereupon waiters, clerks, and clubmen hasten to find how their favorite has run. The large proportion of time, energy, and interest given to sport must detract seriously from the industrial efficiency of the nation at a time when it needs to concentrate all its powers in a united effort to overcome the consequences of a destructive war.

TRANSPORTATION TO THE CITY

Let us then proceed to the City to see what our mining friends are doing. We choose the Bank as the terminus of our incursion, which may be effected either by motor bus or underground railway; to take a taxicab is to squander time and money needlessly; the motor buses are cheap and comfortable, but slow; the two systems of subway with their electrically driven trains are expeditious and convenient, but the air is wearily warm, although not so exhausting as that of the New York subways and much less reverberant with noise. The Bank of England, we find, is undergoing reconstruction, slowly and timidly; even when rebuilt in large part it will be an undignified structure, quite unworthy of its prestige and of its splendid site. I horrified an Englishman by suggesting that this central spot in London, a piece of real estate of transcendent value, should be occupied by a thirty-story building, with a luncheon club in its topmost story, and the whole thing dedicated as a monument to King Edward VII! Arising from amid buildings only three or four stories high, such a structure would be a landmark for all men to see—and a target for enemy airplane bombs!

From the Bank we stroll through devious familiar alleys to London Wall, where are to be found the offices of the chief mining and financial companies, and also the Mining and Metallurgical Club. At that hospitable rendezvous one meets engineers from all over the world; the club, one might say, serves as a gastronomic annex to the Institution of Mining and Metallurgy, which unfortunately is housed at an inconvenient distance from the headquarters of its members. The club is well attended at luncheon time, and even afterward, for professional engagements are too few, and the allurement of the bridge tables holds many that have time to spare. To anybody needing information concerning mining developments in distant corners of the earth there is no place like the Mining Club, and to an American mining engineer, notwithstanding the debt controversy, there is always a hearty welcome.

WILDCATS HAVE HARD SLEDDING

The shrinkage of liquid capital has crippled the London mining market; gone forever are the days when an American spoofer (or spieler, if you prefer) could sell a $50,000 option on a Western mine, in Colorado or California, for £50,000. Those were halcyon days, forty years ago, when Baron Grant and others of his kidney engaged the assistance of impecunious noblemen in placing puling wildcats upon the Stock Exchange, when the ignoble scions of noble families shed the phosphorescent luster of a decaying name upon the pages of a prospectus, and the public thought that a return of sixpence per annum on a pound share was a profit! Gone are the spacious days when German-Jew financiers offered Rand shares yielding 6 or 7 per cent as gilt-edged securities for widows and orphans to the tune of approving reports written by engineers oblivious of the fact that mines are wasting assets and forgetful of the tradition that even Methuselah died! Nowadays any attractive mine that is offered for sale in London is no longer the sport of competitive buying between rival financial groups; the market is so shrunken that to launch successfully a mining enterprise requiring any large amount of capital it is necessary to enlist the co-operative energies of the few houses able to find the

money and competent to attract the support of the public. The dear old "Public" that used to keep things going so nicely for the flamboyant promoter of the late Victorian period has been shot to pieces; the cooks, policemen, clerks, tradespeople, clergymen, and retired officers that found the money for the mining issues of a former day are no longer available for the purpose, the war, income taxes, and, worst of all, sophistication, have spoiled the game beyond recovery.

Overcapitalization Still a Fault

Today money for mines comes not from simpletons but from "investors," a euphemism for serious persons having money wherewith to speculate intelligently. Nevertheless, I was told that even now the application for small allotments of shares is noteworthy, say commitments of £20 to £30, from clerks in the City, small farmers, and petty shopkeepers. Overcapitalization of mining companies is still a common fault and share manipulation by insiders continues to degrade an honorable industry, but to a decreasing degree, partly because the average man is more sophisticated and readier to resent imposition, partly because a higher standard of conduct is gaining ground. The Rand has been wonderful in its development of technique no less than in its production of gold, but it has tended to hurt mining elsewhere, as the Comstock did in our West forty or fifty years ago. With the development of the Rand came the era of big mines and enormous capitalizations; the excessive emphasis upon "ore in sight" killed the adventurous spirit implicit in mining; it obscured the essential risk while promising an assured security; it caused gold mining to be regarded as an investment, which it never was, instead of a speculation, which it always is. The promoters of the Rand overcapitalized the mines by the assumption of persistence of richness in depth, and the engineers, who knew, or ought to have known, better, did not undeceive the public, the result being the transference of several hundred million dollars from the pockets of the trustful many to the wallets of the unscrupulous few.

Consulting Engineers Have Leisure

The mining profession in London is suffering from the dull times, more especially the older consulting engineers. The younger men are more fortunate because wider opportunities are open to them in the mining regions where new work is in progress, notably in Nigeria, the Malay States, and Rhodesia. The status of the profession has improved, however; it is true, the names of bankers, solicitors, and accountants still loom large on the front page of the prospectus, but it is recognized now that to engage public attention it is necessary to state the names not only of these useful folk, and of the directors, but also of the technical men that have appraised the mining property and of those who will be given the management of the proposed venture. For its improved status the profession owes much to the Institution of Mining and Metallurgy, which courageously maintains a high standard of membership, and represents the profession, before the public and the nation, with a dignity and effectiveness that call for respectful appreciation on the part of mining engineers throughout the world.

When I was in London tin was quoted at £310 per ton, equivalent to about 75c. per pound. Most of the production of this useful metal remains in British hands; therefore the London market for tin-mining shares was lively during the last summer. The most profitable mines are those of the Malay Peninsula, where the metal is won chiefly by dredging from alluvial deposits, at the rate of 120,000 cu.yd. per dredge per month. Both open and close-connected bucket lines are used, the buckets ranging from 6 to 12 cu.ft. in capacity. The normal operation is that of two dredges digging in ground 50 ft. deep and extending over 300 acres. It is customary not to increase the plant to three dredges until there is assurance of a productive life of ten years for all three. Exploitation is based upon tests by boring, the holes being spaced 66 ft. apart in rectangular lines equivalent to slightly more than one borehole per acre. The Banka type of drill is used most, this being a hand drill mounted on a platform and worked by four men. The casing usually does not exceed 4½ in. in diameter. When washing the tin-bearing alluvium, the usual practice is to pass the material, which is "ore," through trommels before treatment on fixed inclined tables or sluices, 6 ft. wide, and graded so as just to maintain a flow. A native attendant is on hand to prevent settling, or "banking," by means of a rake. The fineness of the tin-bearing stuff is indicated by the fact that few of the dredges use a screen (on the trommel) of larger than ¼-in. holes. From the trommel the undersize goes into classifiers of the under-current type and then to jigs of the Harz type. The first concentrate contains 20 to 30 per cent of tinstone, together with pyrite, mispickel (arsenical pyrite), magnetite, and other impurities, chiefly iron minerals. To separate them from the tinstone, a barrel or some other similar clean-up device is used, the product therefrom containing 72 per cent of tin. This usually is sold directly to the Straits Smelting Co. at Singapore. Some of the Malayan companies employ magnetic separators, the use of which involves a preliminary heating of the crude concentrate, to render the iron minerals magnetic. The product from this operation is of higher grade, averaging 74 per cent.

Most of these Malayan mines are comparatively small; they have reserves representing a life of from twelve to fifeen years. Nevertheless, they are giving the public a good run for its money, their profits ranging from 30 to 40 per cent on the original capital, equivalent, on current share quotations, to dividends at the rate of from 12 to 14 per cent. This represents a return considerably higher than that of the Rand companies in the days when they almost monopolized the attention of the mining market. Among the best of the Malay tin ventures are the Ipoh, Kamunting, Renong, Siamese Tin, and Malayan Tin Dredging. The only important lode mine is the Pahang Consolidated.

The average rise in the price of tin during the last thirty years has been about $25 per ton per annum, the current price being in excess of that rate of increment, but it cannot be said that it fails to represent the strong statistical position of the metal. A seasonal fluctuation in the quotation for tin is apparent, caused probably by conditions in the trade of the Orient.

Cornish Tin Mining Profitable in Spots

One must not speak of tin mining without referring to Cornwall. In the "old country," of course, the high price for the metal has incited prospecting and prompted sundry efforts to revive abandoned properties. Cornish

mining has been under a cloud during recent years, the only profitable enterprise at the present time being East Pool, near Camborne. The famous Dolcoath mining company has abandoned its old workings and has sunk a deep shaft to prospect in new ground along the South Roskear vein. From the bottom of the shaft a crosscut has intersected a lode 14 ft. wide carrying 33 lb. of black tin per ton of ore. South Crofty paid 20 per cent last year and 5 per cent for the first two quarters of this year (1926), but the high price of coal and other troubles have taken it temporarily off the list of dividend payers, that "list" consisting now, as I have stated, of East Pool solitarily. This mine is in a vigorously healthful condition, and may be regarded as comparatively young, the depth of the workings being only 1,500 ft. During the previous Cornish boom, twenty years ago, an enterprising syndicate, led by Bewick, Moreing & Co., unwatered the Phoenix mine, near Liskeard, but abandoned the effort when a mill had been built, after which the same group reopened the East Pool mine, with notable success. The yield is from 28 to 30 lb. of tin per ton of ore, from a lode 6 to 15 ft. wide. At 1,425 ft. a crosscut recently has intersected 45 ft. of tin ore assaying 153 lb. per ton and 8 ft. of wolfram ore assaying 8 lb. per ton. This is a new development, quite separate from the old workings. The same financial group is developing the adjoining Tolgus mine, a shaft having been sunk to a depth of 2,000 ft. At the 1,700-ft. level a diamond-drill hole has cut a lode 3½ ft. wide yielding 54 lb. of tin per ton of ore; and at the 1,500-ft. level another drill hole, more recently, has intersected 9 ft. of ore containing 56 ft. of tin per ton. The Geevor, a neighbor of the old Levant mine, prosperous in 1825, is another active property, and is earning a working profit, but no dividends have been distributed pending the liquidation of a debt.

THE WAR, high income taxes and sophistication have spoiled the game of the flamboyant promoter in unloading mining shares at unwarranted prices to the "dear old Public." Cooks, policemen, clerks, trades people, clergymen, and retired army officers no longer supply the money. Overcapitalization of mining companies is still a common fault and share manipulation by insiders continues to degrade an honorable industry, but in a decreasing degree. This is partly because of the greater common sense of the average man; and partly because of some improvement in standards of conduct on the part of the promoters.

Wages More Than Double

The Cornish tin mines, few though they be, are enjoying a good price for their tin, but they are suffering from a depression in the market for their byproducts, arsenic and wolfram. Moreover, the coal strike has affected them adversely, the price of coal having risen to 70s. per ton, as against a former normal price of only 27s. High wages constitute another obstacle to cheap mining; miner's pay before the war was 22s. per week; now it ranges from 40 to 45s., according to the number required. In regard to new discoveries and developments, one can easily be too optimistic, for this ancient mining region has been fairly well prospected, so that fresh orebodies will have to be found by crosscutting and diamond drilling at the deeper levels, which means both greater cost and less chances than the detection of favorable evidence at grass roots. Nevertheless, the old spirit of adventure is not dead, among the latest prospecting ventures being the Parkanchy (near Scorrier), which, during the war, was exploited for wolfram, and has been revived as a source of tinstone, under the auspices of the Tin Selection Trust, which is guided by two notable engineers in the persons of Reginald Pawle and E. T. McCarthy. The Wheal Kitty is another old mine that is to be reopened; and at Liskeard the South Phoenix, previously mentioned as the precursor of the East Pool venture, is to be revived by the Base Metals Consolidated, on the initiative of C. F. Roseby. This mine, only 300 ft. deep, was shut down in 1908. It is claimed that tin was produced for a cost of £46 per ton, and that good profits can be made with a cost of £140, which indicates that the reference is to black tin (or cassiterite concentrate, containing 60 per cent of metal) and not to the *stean* of the Celts or the *stannum* of the Romans. The vicinity of Liskeard can boast a number of mines conspicuously productive of copper in days gone by, say fifty years ago. Copper was mined down to twenty fathoms, at which horizon the lodes became tin-bearing. That is the normal relation in Cornwall: wherever tin ore outcrops it is because the copper ore, formerly above, has been eroded. One further remark on the tin market I venture to make, and that is concerning such a high price as £310 per ton: If this be maintained or increased it would incite the use of a substitute, such as zinc, in lieu of tin.

Kaolin Mining Depressed in Cornwall

Another Cornish industry that has seen better days is the china clay. Just before the war it revived, and after the war the demand for kaolin continued lively until the autumn of 1920, when a collapse ensued, as a part of the trade paralysis that overtook the post-war boom. Now the china-clay business is dull, in consequence of an excessive output, but signs of improvement are to be detected. During the war other countries were compelled to exploit their own clay deposits, and, although the quality of their product was poor, they produced enough to injure the market for the Cornish and Devonian mines. The uses for china clay are many, and only about 12 per cent of the output is supplied to the making of pottery, the larger part being consumed in paper manufacture and the textile trade, besides the making of rubber, shoe polish, and tooth powder. Concerning the actual mining of the clay, it remains to say that the monitor is used now to wash the kaolin out of the decomposed granite, this system of hydraulicking being borrowed from alluvial-gold mining, the effect being to leave the stone and sand behind while the water carries the fine clay to settling ponds.

Australian Gold Output Declines

The yield of gold from Australia continues to diminish. That of Western Australia, for example, is now only 40,000 oz. per month, which is less, by 10,000 oz., than the current production from Rhodesia. Most of the old bonanza mines at Kalgoorlie are kept alive in the hope of rejuvenating the companies that own them

by the purchase of mines elsewhere, not in Australia alone, but anywhere; several of these companies have widely scattered investments, and act as promoting agencies. The operations at Kalgoorlie itself are conducted largely without profit, and even at a loss, but the continuance of activity serves to give employment to the local population and to distribute fees among the equally worthy directors in London. The Lake View and South Kalgurli mines are the only ones on the Golden Mile that put anything into the pockets of the shareholders. The mining industry of Western Australia today is harassed by adverse legislation and by highly unfavorable labor conditions; hence the difficulty of promoting any new enterprises; of such the only one worthy of note is the Wiluna, a new discovery in the southwestern part of the state. This caused a flutter last summer, the claim being made that the lode averaged half an ounce of gold for a width of 30 ft., which speaks for itself fairly loudly.

The output of gold from the Transvaal in August was 843,854 oz., against 808,218 oz. in the corresponding month of 1925. This year's production from the Rand will be the greatest in its history, and the profit will be proportionate, for the supply of native labor has been good throughout the year and the cost of working has been steadily reduced to an average of about $4.50 per ton. The Rand may have reached its zenith, as is generally conceded, but it shows no signs of industrial decay, although the limits of profitable development are clearly in sight. The world's premier gold field is now milling 28,500,000 tons of ore per annum; Sir Robert Kotze, until recently (I use this adverb regretfully) Government Engineer, anticipates that in five years the output will be reduced to 22,000,000 tons, and in eleven years to 15,000,000 tons, these estimates being based upon the present working cost. Since 1924 the cost has been decreased by 25c., and the technicians of the Rand, needless to say, are not yet at the end of their tether.

"Investor" in Rand Shares Better Off

Meanwhile the share market is treating the "investor" much better than formerly; the choice properties, on their share prices, yield 10 per cent above amortization or a 13 per cent income based upon a life of twenty-five years. One can buy stocks on an actuarial basis, whereas twenty years ago the public bought them at twice or more times their worth as valued by intelligent appraisal. To what degree of accuracy the long lives of the most productive mines are correctly estimated I do not know, but some of the best brains in the profession have worked on the matter, so that it must be on a safe footing. Increase of depth, however, I may remark, involves not only probable impoverishment of the ore but two other unfavorable factors—namely, the increasing pressure of the overhanging rock (causing the "air" blasts) and the augmenting temperature, which tends to devitalize the workers. Speaking of the best Rand mines, I quote figures of production for the wonderful New Modderfontein, which, in the year ended June 30, 1926, produced 1,532,000 tons of ore for a yield of gold worth £3,356,347, of which £1,992,527 is stated to be profit, although only £1,540,000 was actually distributed to the shareholders. The working cost averaged 17s. 10d., or $4.45 per ton. The reserves are stated to be 9,289,800 tons of 8.6 dwt. ore over a width of 54.8 in. Among the newer developments mention must be made of the Sub-Nigel, which caused a lively gamble in the shares of the company, this being based upon the disclosure of 40 in. of 25½ dwt. ore.

Most of the Canadian issues quoted in the London market are those of companies registered in Canada, to avoid the British income tax, which, it can readily be believed, serves as a check to the English management of mining enterprises in foreign countries. The capitalization of the Canadian companies is stated in dollars and the shares usually are started at a big discount, say 50 per cent. The British public regards such methods with suspicion, because it fails to understand the reason for such a procedure. Several successful silver mines in Ontario appear on the active list of the London exchange, but the recent slump in silver, on account of the proposal to put Indian currency on a gold basis, has depressed the quotations.

Russian Gold Delivered by Airplane

The arrival of gold by airplane from Moscow attracted attention to the Lena Goldfields, which is the only important English company now operating in Russia. This gold represented the proportion of profit accruing to the British owners. The cost of shipment by air is said to be 2s. 9d. per 100 lb., as against 4s. 6d. by sea and rail, using the ordinary passenger service. The Lena Goldfields is able to operate even in a disorderly country such as Siberia, because its product is of small bulk in proportion to its value; gold is easily transported and readily sold; moreover, the mining of alluvial gold does not involve the use of large reduction works, such as are needed in the winning of the base metals. The Tetiuhe mines, in eastern Siberia, about 240 miles north of Vladivostok, are being operated under agreement between the Tetiuhe Mining Corporation and the Soviet Government. The management, under onerous conditions, is producing 50,000 tons of ore yearly, the product being a 44 per cent zinc concentrate and a 60 per cent lead concentrate from ore running 16 per cent in zinc and 10 per cent lead. These products are shipped to Antwerp. The Spassky, Atbasar, and Kyshtim copper mines continue idle; the Sissert company has joined the Lena combination (which now includes the Russian Mining Corporation's properties in the Altai), but not much has been done at this copper property as yet. The Spassky, together with the other companies mentioned, sent a deputation to Moscow, but no terms for a resumption of operations could be arranged. So long as both workpeople and railways are undependable it is impracticable, or foolish, for foreign companies to resume industrial operations on a large scale. There is no chance at present of conducting successfully any operations requiring high technical skill.

Germans Dominate Russian Engineering

The Russians themselves are importing German technicians, because these are not far to seek, and the difficulty of language is avoided by employing Germans from the old Baltic provinces. Owing to the strained relations between the Soviet Government and both the British and American governments, the engineers and mechanics from England and the United States formerly connected with mining and metallurgical enterprises in Russia have been withdrawn from that country; they are losing touch with their former associates and forgetting their Russian speech, whereas the Germans are establishing contacts with Russian industry and in due

course will replace completely those that formerly directed and managed the principal mines and smelters in Russia and Siberia. Before long the British and American agents, engineers, and technicians will become unavailable for a resumption of Anglo-American enterprise in Russia owing to age itself, apart from the fact that they are now scattered to the four winds of heaven. The outlook therefore is gloomy for a renewed participation of British and American capital in the Russian mining industry; nor, it seems to me, is that advisable as long as Russia remains under the tyrannical control of the ruffians that now constitute the Soviet Government. To use capital for reopening the mines and smelters formerly operated by the Anglo-American companies is to throw good money after bad. The agreements of the Soviet officials are mere scraps of paper. The Russian Government is in the hands of outlaws and, even if they decided temporarily to keep their engagements, we have no assurance whatever that their government may not be subverted at any time by logical operation of the anarchistic forces that they themselves have called into being and that they endeavor so sedulously to use for destroying civilization in other countries. Terrorism is still rampant in Russia. When the big agricultural estates were broken into small holdings, the former proprietors were allowed to retain a small part of their estates, the big house and the remainder of the land being given to the people of the village—that is, to the former employees of the landlords. These, being educated men, understood the business of farming, and soon proved that they could work their diminished holdings more successfully than the ignorant men that had gained possession of the other parts of the original property; whereupon the Soviet Government looked upon them as a nuisance, and transported them to Siberia. Another form of terrorism has been applied to the educated and professional class by means of the housing committee, which has issued regulations for the complete filling of every domicile. The owner of the house is allotted one or more rooms, according to the size of his family, and the other rooms are set aside for new tenants scattered from the so-called proletariat. This means that the scum of the streets invades a man's home, to live with his wife and children, the consequence being a kind of cruelty easily imagined, and including acts not fit for publication. Evidently the deliberate policy of the Soviet is to suppress, cripple, or kill the intellectual element that is not wholly in sympathy with the savagery that now dances on the Russian stage as an expression of advanced culture.

GERMANS are establishing strong contacts with Russian industry and are likely, in due course, to replace completely those—including British and American—that formerly managed and directed the principal mines and smelters in Russia and Siberia. Before long these former agents, engineers, and technicians will become unavailable for the resumption of activity in Russia; so that the outlook is gloomy for renewed participation of Anglo-American interests in the Russian mining industry.

TIN FROM KATANGA

While in London I went to the meeting of the Zambesian Exploration Co., which is one of the prospecting enterprises launched long ago by Robert Williams for the purpose of exploring and developing the mineral resources of Central Africa. The other company is the Tanganyika Concessions, which at one time held 40 per cent of the stock of the Union Minière du Haut-Katanga, the Belgian company that is exploiting so successfully the rich copper deposits of the Upper Congo. The English holding in this enterprise is now only 30 per cent, but Mr. Williams is a vice-president of the Belgian company and an active personality in the management. Last year the production was 90,104 tons of copper from 7,388,453 tons of ore. Incidentally, I may mention that 854 tons of tin concentrate was shipped from the Busanga mine, in the Katanga, for reduction at the Hoboken smelter, near Antwerp. This shipment is significant, for the western part of the Katanga province is known to contain extremely rich deposits of tin, both lode and alluvial. Mr. Williams delivered a speech reviewing operations and results, at both the Tanganyika and Zambesia company meetings. He is always interesting, because he has been, and is still, one of the great pioneers of African exploration, a former associate of Cecil Rhodes, and a man of indomitable courage, as well as of proved integrity. The question arose in my mind, as I heard him speaking, why is it that such a man should have been overlooked in the award of honors so lavishly splashed over men of much smaller caliber and of relatively insignificant accomplishment.

Just now Mr. Williams is making every effort to complete the railroad from Benguella to the Katanga; this railroad to the Atlantic shore, as compared with the two existing routes to the east coast of Africa, will save 500 miles of rail haulage and 2,700 miles of sea transport in the shipment of copper to European or American refineries. The Benguella railroad is to be finished to the Angola border at the end of 1927. Then the Belgians will build the extension needed to connect with the present line, which runs from Bukama to Elisabethville, and thence to Beira or Cape Town. The delay in the completion of the Belgian portion of the railroad building will save money in construction, but it will postpone the final completion of this industrial artery until 1929. The new leaching plant at Panda is expected to be ready in two years; meanwhile the company will make use of all its reduction plants, smelting the high-grade ore in the reverberatory furnaces, without discarding the blast furnaces entirely, while the poorer ore will be concentrated both by water and by oil in existing mills. Delays in construction are inevitable, owing to the remoteness of the region, and scarcity of labor is becoming an increasing check to expansion.

COPPER DEVELOPMENTS IN RHODESIA

The copper resources of Northern Rhodesia, on the southern flank of the Zambesi-Congo divide, are being developed vigorously under the leadership of A. Chester Beatty, P. K. Horner, and Carl Davis. The principal company is the Rhodesian Congo Border Concession, of which the Bwana M'Kubwa is a subsidiary. Recent exploratory work at N'Changa, under the management of Raymond Brooks, has been sufficiently satisfactory to justify the organization of another company, the

N'Changa Copper Mines. Mr. Horner estimates that 700,000 tons of 4 per cent copper ore has been proved down to 200 ft. on the main lode. Meanwhile, the Bwana M'Kubwa company, under the management of Harold T. Dickinson, has opened up a new orebody on the site of the old N'Kana diggings. Development has proceeded at the rate of 800,000 tons of 5.4 per cent copper ore per 100 ft. of depth on a length of 3,600 ft. The ore-bearing beds of schist have been traced for three miles. Here is a potential producer of considerable magnitude. Conditions of work are improving, and these deposits therefore are likely to be of importance within five years.

When returning by motor bus from the City to a hotel in the West End, one notices the congestion of traffic; if it is no worse than in New York, despite the narrowness and crookedness of the old streets of this ancient city, the favorable result is due to the extraordinary skill of the drivers, the efficiency of the police, and the good nature of everybody. Respect for the law helps English civilization at every turn; it is a characteristic for which we may well admire the little island that "fate and the ocean and some fostering star" have made so great. The policeman is respected, and therefore functions admirably, but one may be permitted to wonder why horse-drawn vehicles are still permitted to obstruct the movement of motor-driven traffic. Large trucks, including His Majesty's mail wagon, drawn by a single heavy horse, crawl along stupidly, setting the pace, in narrow streets, to the impatient stream of automobiles. Why should not notice be given, say, five years in advance, of a regulation to exclude horses from within the congested area? The filth and the delay due to the employment of animals seems as much out of date as teams of oxen or goat-carts at the hubs of modern civilization, whether Paris, London, or New York.

London More Prosperous Than Outside Districts

London does not give one a correct picture of conditions in England; in the metropolis the spending of money by visiting aliens gives a wrong idea of prosperity; to see the real status of industry one should go to Bradford, Manchester, or Glasgow, where unemployment of the workers and idleness of the factories speak eloquently of the difficulties that are being faced so manfully by the British. The mining industry, like the others, has been crippled by the numerous strikes that have interrupted work at the factories, because the inability to obtain delivery of machinery parts without painful delays is a serious check to profitable mining operations by companies registered in London. Some of these strikes, such as the miserably stupid and long-drawn coal strike, have been incited and aided by the Russian bolsheviks, their outspoken intention to subvert government in England making a curious commentary on the recognition of the Soviet by the British Government.

Business is slack in London, as elsewhere. The Stock Exchange has remained closed on Saturday mornings, as well as afternoons, ever since the war, and long week-end holidays are the custom among the gentlemen of the City. Their hours are short; on average they work a day per week less than their competitors in New York and Chicago.

Hard on British Industry

The cumulative effect of this comparatively lessened activity must be serious to British industry. Undue devotion to sport and a certain good-natured sloth are not helpful to national prosperity, however much they may minister to the pleasant amenities of life. The burden of taxation lies heavy on office and home; among the less favored by fortune the incentive to thrift has been weakened; the urge to spend and gamble has been strengthened, particularly among the younger generation, which has not yet recovered from the war-time spirit of reckless extravagance, itself the consequence of an uncertain future and a lack of security in business affairs. The people of the United States, largely detached by distance from the direct effects of the war and easily forgetful of a catastrophe in which we were but slightly involved as compared with our European allies, has rebounded quickly to a condition of extraordinary prosperity. Our loss was comparatively small in men and money; their loss in money is emphasized by the controversy over the debt settlements, but of the greater loss of the French and the English we hear but little—namely, the death of the young men that, had they lived, would have been the leaders of the nation. The progress of mankind in general, and of any people in particular, depends not upon the average man but upon the born leaders, the especially gifted ones; of these, France and England lost a large proportion; the loss is irreparable. If we cannot compensate or ameliorate that bereavement, grievous in its ethnical, industrial, and spiritual implications, we should, at least, be sympathetic; we should take off our hats in respect and extend our hands in comradeship to those who fought with us, and before us, in behalf of a cause that we believe to be identified with the welfare of humanity.

New Mill of Nevada City Consolidated Mines Co., Nevada City, California

Elemental Sulphur in Smelter Gases, and Its Elimination

Dangers to Baghouses May Be Avoided by Increasing Arsenic or Lead Content of the Charge

By G. Newton Kirsebom
Metallurgist, New York City

G. Newton Kirsebom

UNTIL about two years ago there was much trouble in Western smelters because of the presence of elemental sulphur in the flue dust coming from Dwight-Lloyd sintering machines. A certain amount of this would be volatilized during the sintering and enter the flues, part of it condensing out on the sides of the flue, but most of it, going on with the dust, gradually forming finely divided particles, which, when present in sufficient quantities, would give rise to spontaneous combustion, often causing considerable damage. The phenomenon is not unlike that experienced in coal mines, where finely divided dust will cause explosions of a similar nature.

Where Cottrell precipitators are installed, damage from the source noted can never become considerable, as the force of the explosion will dissipate itself through the pipes and only small local disturbances in the flues will occur. Where, however, the baghouse system is retained, it becomes a matter of great importance, as the explosion is very likely to destroy the bags, not only by reason of its force and temperature, but also on account of the accumulation of elemental sulphur in the bag fibers themselves, which makes them an easy prey to temperature changes in the flue caused by such explosions. This is exactly what happened at the Midvale smelter of the U. S. Smelting, Refining & Mining Co. in February, 1925, when an explosion in the flue caused all the bags to blow up in a fraction of a second. Except for a minor explosion in the preceding month which caused the loss of a few bags, the plant had not suffered from this kind of trouble since 1914, when the Dwight-Lloyd machines were installed, and it was generally believed that the explosions occurring at that time were due to conditions arising from unfamiliarity in the use of the machines. Not much attention had been given during all these years to the formation of elemental sulphur in the sintering operations, but last year it became a matter of great concern to the plant. It was apparent that if a remedy could not be found for this trouble, Cottrell precipitators would have to be installed ultimately. This the company was reluctant to do, as such precipitators usually give less clearance than woolen bags, and maximum clearance was of the greatest importance, as the smelter is situated in a farming district.

Conditions governing the formation of elemental sulphur had for a long time been puzzling to most smelter operators. The Salt Lake Valley smelters were much troubled by this condition, whereas the East Helena plant, in Montana, as well as the smelters in the Missouri district, were entirely free from it. It was early realized that the presence of pyrite in the charge was the greatest element of danger. The explosion in February, 1925, at Midvale is said to have been caused mainly by the presence in the charge of large amounts of Apex table concentrate, which carries a heavy percentage of pyrite. The roaster crew named the material "dynamite" after the explosion, and for months afterwards it was carefully kept out of the charges.

Suggestions for overcoming the trouble were numerous. The most immediate concern of the management was to take precautions to hinder combustion starting in the flue. The charges were composed so as to give not too high temperature in the flue and thus to keep from endangering the new bags in this way. Whenever the sintering plant was shut down the dampers were immediately closed so as to avoid a great inrush of air at that stage. Furthermore, lime was automatically fed into the flue to act as a diluent in the flue dust.

The fact that the explosion occurred in the winter time was considered of great importance. The gas in the flue would then cool down quickly, and elemental sulphur would condense both on the walls and as finely divided dust in suspension. Electrical measurements were made to find out whether the combustion could have been due to static charges in the finely divided sulphur particles, but the static charge did not seem adequate to cause such combustion. It was generally believed that the elemental sulphur was formed by direct distillation of the loose atom of sulphur and that means should be found for a more complete oxidation. This to be done on a machine where the oxidation conditions are almost perfect! An idea favored by many was to lead the gases from the first wind box over the charge into the second, as it seemed that almost all the elemental sulphur came from the first box. This scheme seemed attractive at first, but the required mechanical arrangement proved difficult. Then it was found that even when all pyrite was taken off the charge, which was then composed only of preroasted concentrate and fluxes, the elemental sulphur would form just the same.

Composition of Charge the Vital Factor

In starting my investigation in May, 1925, I soon came to the conclusion that the trouble had to be attacked at its source — namely, in the charge itself. Since the trouble was not universal with all smelters, it was indicated that the composition of the charge might be the vital point. Looking over some of the reports of these other smelters did not seem to give many clues. Many points were brought out that seemed contradictory. I then recalled the way in which arsenic sulphide used to be manufactured, the process being to sublime arsenic trioxide and bring the vapor

of sulphur over it, which at once gave arsenic trisulphide. I then suggested that some crude arsenic from the plant itself be introduced in the charge to one of the machines and that the results be then compared with the results in the other machines. Individual baghouses were put up in two of the flues from each machine going into the main flue. A certain amount of crude arsenic was introduced in one of these machines and the dust from the two machines removed at intervals from the bags during a twenty-four-hour run. The result was beyond expectation. With only a 2 per cent addition, by weight, of crude arsenic in one of the machines, the elemental sulphur decreased from 10 to around 2 per cent in the dust.

Furthermore, in looking over the records, the astonishing discovery was made that at the time of explosion the arsenic content in the flue dust had been at a minimum of 4 per cent, whereas in the preceding year it had averaged around 15 per cent. In the years preceding that, the arsenic contents had been very high (32 to 40 per cent), owing to the high price of arsenic, which made it profitable for the plant to incorporate barren arsenic ores with the charges.

These two facts seemed to establish at once the rôle of arsenic as a preventive of the formation of elemental sulphur. After some additional tests the plant settled down into finding a way of introducing the arsenic (an unprofitable necessity) with not too much economic loss. The return of crude arsenic or blast-furnace dust would be a dead loss. Barren arsenopyrite was tried out for several weeks, and good results were obtained. After a little while, the company made a contract for handling the ore of the Walker mine, in Nevada, which contained 30 per cent lead and 20 per cent arsenic in oxidized form. It proved to be a great find. This ore caused for weeks an almost complete elimination of the elemental sulphur, besides being profitable to smelt.

How Elemental Sulphur Was Formed

In the meantime the character of the formation of elemental sulphur was still puzzling me. How could it be that, with no pyrite in the charge, the elemental sulphur would still form? And why was it that the Missouri smelters, which handled ores entirely devoid of arsenic, did not have the trouble? I then made some laboratory tests, heating pyrite in a silica tube and passing air rapidly through it. There was a complete oxidation, with no formation of sulphur. I then added steam with the air, and conditions immediately changed. I got finely divided elemental sulphur coming out of the other end of the tube. There was now no doubt of the conclusions to be drawn. The reason for the formation of elemental sulphur is not incomplete combustion, but the phenomenon is due to the large amount of moisture, essential to the D. & L. charge. During sintering there is a primary formation of hydrogen sulphide, which immediately takes hold of the sulphur dioxide, forming elemental sulphur.

1. $2FeS_2 + 2H_2O + 2O_2 = 2FeO + 2H_2S + 2SO_2$
2. $2H_2S + SO_2 = 2H_2O + 3S$

This reaction is most marked with pyrite, but will also take place with other sulphides such as those of zinc and lead.

Thus, the formation of elemental sulphur is automatically taking place owing to the presence of moisture in the charge. The arsenic in vapor form steps in between the two reactions given above and prevents the latter from taking place as:

$$As_2O_3 + 3H_2S = As_2S_3 + 3H_2O$$

Still there was the question of the East Helena plant, which uses heavy pyrite in the charge and has no arsenic-bearing ores. Why was it, also, that the Walker ore, carrying both arsenic and lead, gave superior results to barren arsenical ores?

The solution was not far away. Lead oxide, like arsenic trioxide, will sublime at the temperature of 2,200 deg. F., which is reached in the ignition zone during roasting. This lead oxide will, like the arsenic, take hold of the hydrogen sulphide formed, giving minute particles of lead sulphide, which pass out with the dust.

$$PbO + H_2S = PbS + H_2O$$

Therefore, whenever the lead content of the charge is high, as in the Missouri plants, a profusion of lead oxide forms just below the charge, which chokes any elemental sulphur formed with the moisture. If the lead content of the charge is low, as in the Salt Lake Valley district, arsenic acts as a compensator. Where both are low, and a high pyrite content is present, so as to give a good sinter, the danger is imminent.

So it happened that the Midvale smelter, with the price of arsenic high following the outbreak of the war, began to pass in large amounts of arsenic ores along with low-lead charges and, though unaware of it, protected the operating company until the slump in arsenic set in. The arsenic was then taken off the charge, the Apex concentrate (which give a wonderful sinter, by the way) was used without knowing the consequences, and things began to happen.

The presence of elemental sulphur in the flue dust has now become a matter over which the individual smelter will have control. In regions where, for certain reasons, it is necessary to carry a low lead percentage in the charge, addition of arsenic becomes of importance. In such fortunate places as can carry a high lead percentage the matter becomes of no importance.

The condensation of elemental sulphur in the bag filters is considerable. In one case, a piece of a bag which had been removed and cleaned of dust, and weighed before and after a treatment with carbon bisulphide, showed 3.5 per cent of the weight of the bag, and around 60 per cent of the weight of dust taken out with it, to be elemental sulphur. There are also frequent instances of slow charring of the bags themselves. This may be due to the intimate mixture of elemental sulphur and wool-fiber, which, like oiled cloth, will result in a rise of temperature. The only remedy for this is, of course, to prevent elemental sulphur from reaching the bags. There have, however, been indications that large amounts of arsenic prevent such condensation in the bags, although this cannot be said with surety.

The solution of the problem of explosions in D. & L. flues is, of course, a matter of minor interest to plants using Cottrell precipitation. But, even so, the facts brought out might serve the smelters as an indication of how much might be accomplished by adjusting conditions in such a way as always to carry a high lead percentage on the charge, leaving it to the millmen to concentrate whatever can possibly be concentrated. That this is also the more economic way no smelter superintendent will deny.

Discussion

Importance of Gold to Civilization

THE EDITOR:

Sir—To take T. A. Rickard's paper on "The Later Argonauts" and read it in physical comfort is a feast of mental culture and thus brings to the individual, for a few brief moments, an experience of that state of living which is suggested by Mr. Rickard as the ultimate aim of modern civilization.

The concluding paragraph in which Mr. Rickard outlines the argument for a direct connection between the gold content and tonnage of certain alluvial deposits, and the expansion of industry, the world growth of population and the increased political power of the working classes, is certainly "a rough-hewn fragment of a sculptured gem," as the gentleman, who was ignorant of lapidary methods, said when he wished to avoid the hackneyed phrase "a jewel of literature."

From the considerations therein outlined the very maintenance of our present system of civilization seems to rest on the continuance of a supply of gold, adequate, at least, for the needs of the expanding industry and widening commerce of the ever-growing population of the civilized countries of the world. If this be true with world industry and population still increasing, and the production of gold stationary or decreasing, disaster seems to lie ahead. Surely, then, the discovery of fresh sources of gold supply must be a matter of supreme importance. Yet it may be said that the use of gold as a means of exchange between individuals is almost unknown in England, and that the fortunate financier or manufacturer can travel from country to country in Europe and transact business involving enormous sums of money and yet never see a single gold coin, or even cause one to be handled. Obviously, then, some factor or factors must have been overlooked.

The chief fallacies involved in the argument for the supreme importance of gold to our present system of civilization are not far to seek. One of these is the idea that gold is still primarily a means of exchange. This has long ceased to be true in the vast majority of business transactions, although it still holds true in certain dealings. It is essentially true, for example, in trade, with partially civilized races who insist on payment for goods by gold coins which they, in turn, use for ornaments or barter for other goods; but in modern commerce it often is not true. Two properties of equal value may change hands, the value of the properties may run into many thousands of dollars or pounds, and yet the only medium of exchange which is involved is an intrinsically worthless amount of cellulose and ink—i.e., some checks. The value of these checks depends on the credit balances behind them, and those credit balances might quite possibly in actual practice rest on the possession of the respective properties exchanged—no gold being involved in the exchange at all.

The secure possession of the properties both before and after the transaction rested on the legality of the exchange and the political and social stability of the state or states in which the properties were situated, and, in this particular case, not on the possession of any gold either as a means of exchange or as a basis of credit. The number of pounds or dollars "paid" for the properties is merely a measure of their value in terms of an arbitrary standard of measurement generally employed in trade and industry.

This fallacy that gold is essentially a means of exchange in *modern* trade and industry was extraordinarily deeply rooted in the minds of many people before 1914. One of the most striking examples of this was the argument of a certain very able Prime Minister that "Protection" was essential for Great Britain because of the weight of gold being lost by that country annually. He calculated this weight of gold from the weight of a sovereign and the amount in pounds sterling of the excess of the imports over the exports (visible and invisible) of that country for a period of years. A study of the bullion movements reported in the columns of the daily papers over the same period would have given an entirely different figure.

The other great fallacy is that gold is essential as a basis of credit in commerce and industry; that is to say, that it is essential as a basis of credit *as such*.

Credit, in the sense of the amount of money to one's credit at the bank, or in the sense of the cash balance on the credit side of a mining company's profit-and-loss account, is not the same as credit, as such, in financial transactions, although the one may involve or include the other. A brief consideration of the word itself is sufficient to indicate the nature of this difference. Credit is another word for confidence. In commerce and finance, credit may be taken to be a measure of the confidence of a trader or investor in the ability and willingness of an individual, a corporation, or state to fulfil contracts or to pay interest. Essentially such credit is based on a knowledge of the resources and the honesty of the contracting parties—that is, on the confidence of the trader or investor in the ability *and intention* of the contracting party to carry out its obligations. The ability may be present but not necessarily the intention, or the ability and the intention may be liable to be influenced by other factors. In such cases gold is necessary as a basis of credit.

Where confidence in ability and intention to pay and in political and industrial stability is complete, gold itself is not essential as a basis of credit. Resources in goods and other forms of accumulated wealth are adequate. Nevertheless, even in such cases credit is expressed in terms of gold values and all the associated transactions are carried out in terms of gold; namely, on a money basis resting ultimately on a gold standard, that is, in most stable countries.

Where confidence is completely absent, gold itself is essential as a basis of credit to the full amount of the

transaction involved. Both complete confidence, which involves complete economic and political stability, and complete lack of confidence, are today uncommon in practice. Most financial transactions, therefore, at present involve, indirectly at least, employment of gold itself.

An example of the latter extreme case, where confidence was absent and gold to the full amount of the sums involved was necessary as a basis of credit, could be found in some of the post-war engineering contracts between Swedish firms and the Russian Government. The latter had to pay in gold half the amount involved in the contract with the order, and at the same time deposit the balance of the amount in gold in a bank in Sweden.

An interesting example of the former extreme case where confidence was complete between the contracting parties occurred during the last century. The government of a certain small agricultural community which wished to carry out some relatively large public works of a civil engineering nature failed completely to raise an external loan on the security of the increased prosperity expected to result from the work proposed. The government could show no gold reserve or its equivalent to cover the loan. Gold was here essential as a basis for external credit, for external confidence was lacking. The government could not raise a sufficiently large internal loan because the community was not rich enough, but internal confidence in the ability and honesty of purpose of the government and in the unlikelihood of war was complete. The population were therefore willing to accept all payment for labor and materials by a special issue of local paper money.

The work was carried out and some thousands of pounds expended without any gold being involved in the transaction either as a means of exchange or as a basis of credit. Although the expenditure was expressed in terms of money and based on a gold standard, the credit was obtained and the amount repaid directly from the products of the labor involved. This was possible because peace, ability, honesty, and confidence happened to coexist there at the time, although the existence of the three former quite rightly did not render gold unnecessary as a basis of credit for the foreign investor.

Thus one may claim that in commerce and industry as a whole the proportion of actual gold used as a basis of credit is largely a measure of the honesty and mutual confidence of the contracting parties and of the economic and political stability of the countries involved.

The more honest mankind becomes, as long as skill and judgment keep pace with honesty, the less will actual gold be required as a basis of credit. This is, of course, true only so long as there is also security against war and industrial unrest. This in turn rests upon confidence between the nations and parties concerned.

The United States has led the world in urging disarmament as a means of preserving peace between nations and has led the world in the better organization of industry as a means of preserving peace between employer and employed. If the great Republic finally achieves these aims it will do much to reduce the world's requirements for gold, or, conversely, greatly aid the expansion of industry and growth of population on existing supplies.

If, ultimately, under the stimulus of the democratic ideals so much praised by Mr. Rickard, honesty, skill and judgment become universal amongst financiers, investors, and all mankind, the world's requirements for gold as a basis of credit might be reduced to a solitary gold dollar placed under the care of the Bureau of Standards.

With human nature as it is, and honesty, skill, and judgment far from universal, gold in considerable quantities is essential to our system of civilization, particularly for the mechanism of banking—that is, the accumulation, distribution, and exchange of credit. If adequate supplies of gold be not forthcoming, the system of credit based on gold, which was such a great agent in the waging of the World War, may yet be the great agent in the coming of a world peace.

London, England. BERNARD W. HOLMAN.

Grinding Efficiency

THE EDITOR:

Sir—A discussion of E. H. Rose's article on "Grinding Efficiency," which appeared in *Engineering and Mining Journal* of Aug. 28, 1926, is perhaps somewhat belated. However, I believe it will prove of interest to point out that there is only slight difference, if any, between Mr. Rose's method for calculating grinding efficiencies and that of Del Mar in applying Rittinger's law. This will become apparent from the following.

The table presented herewith gives a comparison between the "degree of fineness" as determined by Mr. Rose and the number of energy units as determined by the Del Mar method of applying Rittinger's law. To make the results directly comparable to those of Mr. Rose, the average size of the —200 mesh material was taken as 0.0029 in. The screen test used is the same as that of Mr. Rose's primary mill feed (Table II on p. 334). Column D of the table gives the energy units obtained by the Del Mar method of multiplying the percentage weight retained on each screen by the reciprocal of the diameter. Column E was obtained by multiplying results of Column D by 0.0029×100, and it is seen that these figures agree exactly with those of Mr. Rose's Column A × B, from which he obtains his figure 11.33 for the "degree of fineness" of this particular material. This is as might be expected, as his "per cent of standard" is calculated by dividing 0.0029 by the diameter in inches and multiplying by 100, or "per cent of standard"

$= 0.0029 \times \frac{l}{d} \times 100$, which is the same as our Column E.

Mesh	A Average Diameter (d)	B Reciprocal of Average Diam. 1/d	Roses' Per Cent of Standard	C Roses' Primary Mill Feed, Per Cent Weight	D Energy Units B×C	E 100×0.0029×D
+1½ in. round..	1.625	0.615	0.18	3.60	2.214	0.64
1¼ in. round..	1.375	0.727	0.21	4.28	3.112	0.90
1 in. round..	1.125	0.889	0.26	7.80	6.934	2.03
¾ in. round..	0.875	1.142	0.33	9.00	10.278	2.97
½ in. round..	0.625	1.600	0.46	16.60	26.560	7.64
+3 mesh.....	0.382	2.618	0.76	11.81	30.919	8.98
4.....	0.224	4.464	1.30	5.81	25.936	7.55
6.....	0.158	6.329	1.84	7.22	45.695	13.28
8.....	0.112	8.929	2.59	4.61	41.163	11.94
10.....	0.079	12.66	3.67	3.92	49.627	14.39
14.....	0.0555	18.02	5.23	3.46	62.349	18.10
20.....	0.0394	25.38	7.36	2.70	68.526	19.87
28.....	0.0280	35.71	10.36	2.60	92.846	26.94
35.....	0.0198	50.51	14.65	2.74	138.397	40.14
48.....	0.0140	71.43	20.71	2.20	157.146	45.56
65.....	0.0099	101.01	29.29	0.81	81.818	23.72
100.....	0.0070	142.86	41.43	2.36	337.150	97.77
150.....	0.00495	202.02	58.58	1.10	222.222	64.44
200.....	0.0035	285.71	82.86	0.69	197.140	57.17
—200.....	0.0029	344.82	100.00	6.69	2306.846	669.00
				100.00	3906.878	1133.03
Average.....					39.07	11.33

The difference between Mr. Rose's method and that of Del Mar then lies only in multiplying the Rittinger energy units by a constant. This cannot be considered a real difference when results are used only in a comparative sense.

Mr. Rose, on page 331 of *E. & M. J.* of Aug. 28, points out the faults of the Rittinger "relative mechanical efficiencies," but it is hard to see how his method is much of an improvement. By regarding the —200 mesh material as all of 0.0029 in. diameter he does reduce the usual large proportion of energy units for this size, but even then he still has a very large proportion left (over 50 per cent of the total in the above screen test). Little appears to be gained by this arbitrary procedure.

The presence of finely divided clay along seams or fissures which is freed as crushing progresses may give confusing results and perhaps too much credit to some crushing machine, but this is a factor which can be observed with any given ore. It is hard to consider the results as calculated by Mr. Rose as representing averaged screen analyses. For example, let us take his primary mill feed being represented by a "degree of fineness" equal to 11.33. If we refer to his "per cent of standard" column this would indicate an average size of between 28 and 35 mesh, or, if we calculate it, 0.0256 in. This does not impress one as a figure for average size, when less than 17 per cent of the material is finer than this. A size for this material at which 50 per cent by weight is coarser and 50 per cent finer is 0.4705 in., or between 3 mesh and ½-in. round hole. These figures do not agree, because the quotient of a constant divided by an average of a series of numbers does not equal the average of the quotients obtained by dividing the same constant by each of the same numbers in the series. It is, therefore, obvious that the idea of averaged screen analyses gains little from the results obtained by averaging "per cent of standard."

For purposes of comparison with other correlated observations, results obtained by Del Mar's method of applying Rittinger's law, or by averaging screen tests, using mesh weights will serve just as well and will stand up under the same proofs which Mr. Rose has applied to his method.

HENRY A. BEHRE.

New Haven, Conn.

Rugged

THE EDITOR:

Sir—I wish to call attention to the frequent misuse of the word rugged by your advertisers and others, as though it were synonymous with "strong." The definition of rugged, according to Doctor Annandale's dictionary, is as follows:

> Rugged: full of rough projections on the surface; broken into irregular points or prominences; rough, shaggy, rough in temper, hard; crabbed; austere."

It is no recommendation for any kind of machinery to be rugged.

In an advertisement of anti-friction bearings in your current issue appears the following: "Into every bearing is built the ruggedness and reliability which foreshadows life-long service, etc." Ruggedness in a bearing—could anything be more inappropriate?

The Pas, Manitoba. FRANCIS F. EVANS.

"An Excursion Into Rouyn"

THE EDITOR:

Sir—I was interested to read A. B. Parsons' excellent article, "An Excursion Into Rouyn," which appeared in the *Engineering and Mining Journal* of Oct. 30 and Nov. 7, 1926. In general, it is a most excellent story of this new Quebec area, but there are discrepancies in Mr. Parsons' version of the Quebec mining laws, which I think should be corrected.

Mr. Parsons states on page 730 of the Nov. 7, 1926, issue:

> "The mining laws of Quebec provide for the performance of twenty-five days' work for each claim the first year, and fifty days' work the second. There is also an annual tax of $20 on each claim, the purpose being to discourage the holding of claims for speculative purposes. A payment of $5 per acre is necessary to obtain a 'concession,' comparable in a measure with a patent in the United States, and even this grant, I understand, does not prevent the government from recapturing the claims if certain annual expenditures are not made in connection with them."

Actually the work requirements of the Quebec mining laws are briefly these:

1. Twenty-five days' work must be performed on each mining claim within six months after the date of staking. The months of December, January, February, March, and April being months of grace, are not included from the date of staking as working months. Consequently, the work on a claim staked on Nov. 1, 1926, would not come due until Oct. 1, 1927.

2. At the end of six months a mining license costing $10 must be taken out on each group of claims and an annual tax of 50c. per acre must be paid. The Quebec department has ruled that a single mining license can be taken out on five or less contiguous claims filed on one mining certificate, and no mining license on any one group exceeding two hundred acres can be taken out unless by special permission of the Quebec Department of Mines. According to the Quebec mining regulations, five claims of forty acres each can be staked out on each mining certificate and each prospector is permitted to stake out two hundred acres on his own mining certificate and four hundred acres on two other mining certificates on behalf of other individuals.

3. Claims are then kept in good standing each year by complying with regulation (2).

Quebec mining claims can be brought to a patent at any time, and the granting of this patent does not depend upon fulfilling annual work requirements for a stated period of years, as in Ontario and in parts of the United States, but depends upon the observance of the following conditions:

1. Filing of a "Proces Verbaux" by a Quebec land surveyor at the Quebec Department of Mines, stating the actual acreage that is comprised in a given group of claims.

2. The filing of a mineral specimen at the Quebec Department of Mines accompanied by an affidavit stating that this specimen comes from the claims in question.

3. On the completion of (1) and (2) the Quebec Department of Mines will grant a mining concession to the owner on the payment of $5 per acre; that is for

mineral lands containing the *"superieur"* metals, and $3.50 per acre for lands containing the *"inferieur"* metals. These *"superieur"* and *"inferieur"* metals are defined in the Quebec mining statutes.

4. After the granting of a mining concession, the owner of the claims of the concession must file a statement at the Quebec Department of Mines that he has caused to be expended in mining work on these claims an amount equivalent to $5 per each acre comprised in the concession.

5. On the filing of this statement by the owner or by his agent, letters patent are issued to the owner.

6. After the granting of the patent, the owner must complete each year the equivalent of $200 worth of mining work per each unit of two hundred acres, or else pay an annual tax of 10c. per acre.

Swastika, Ont. R. D. HOFFMAN.

Consultation

Refrigeration of Mine Air

"What progress has been made toward artificial cooling of mines or the air drawn into mines?"

The Village Deep on the Rand, in South Africa, has now reached the depth of 7,300 ft., and its Turf shaft is below depths reached in any other shaft in the world. Experimenting on a small scale, the management of the Village Deep, according to the *Mining & Industrial Magazine*, has sent down blocks of ice to the lowest levels. It was found that by merely placing blocks in various parts of the workings the temperature was reduced only to a small degree.

By melting the ice and spraying the ice-cold water into the ventilating air, an appreciable lowering of the air temperature has resulted. In addition to cooling by ice, the management is doing everything in its power to improve conditions by means of ventilation.

Ice cooling has so far only been carried out on a limited scale, and it is too early yet to prophesy as to how it might be applied to the whole of the workings. The management is hopeful of permanent success.

The best-known instance of mine refrigeration on a large scale is the Morro Velho of the St. John del Rey Co., Ltd. The outside air, at a temperature of about 80 deg. F., with a moisture content of about 120 grains of water per pound of dry air, is cooled by refrigeration to a little above 40 deg. F., which at the same time reduces the moisture content to a little over 40 grains of water per pound of dry air. This cooled and dried air is circulated throughout the working places by fans, one being on the surface and one at the top of the upcast on the 4,126 level. However, in passing down through the mine workings to the working faces, the air current takes up enough heat and moisture from the surfaces with which it comes in contact, so that by the time it reaches the working face it has a dry-bulb temperature of 98 deg. F., or essentially the same as it would have if it had not been cooled at the surface. The moisture content, however, is not so great, being only about two-thirds that of the ventilating current at the working face when it has not been cooled and refrigerated. The net result, however, was that the cooling power of the ventilating current, as determined by the wet kata-thermometer, was increased from 7.7 up to 20.5 millicalories per square centimeter per second. Of this improvement of the cooling power 80 per cent was due to the lowered temperature of the air and 20 per cent to increased velocity caused by the second fan.

It is interesting in this connection to note that the original condition, which gave a cooling power of 7.7 millicalories per square centimeter per second, was a temperature of 101.5 deg. F. dry bulb, 87 deg. F. wet bulb, and a computed air velocity of 220 ft. per minute, which corresponds to an effective temperature of 88 deg. F. The condition after refrigeration, and after the second fan was installed, was 97.4 deg. F. dry bulb, and 76.2 deg. F. wet bulb, and an air velocity of 540 ft. per minute, corresponding to an effective temperature of 78.7 deg. F. If, however, the air in its original condition had been saturated, through the evaporation of water into it near the working face, both the dry-bulb and wet-bulb temperatures would have been reduced to 87 deg. F. and a velocity of 560 ft. per minute would have produced an effective temperature of 78.7 deg. F., thus giving the same cooling power as was produced through refrigeration and drying at the surface.

There are various reasons why it may prove inconvenient or undesirable to saturate the ventilating current of air just before it enters the working places, and, as pointed out above, the reducing of the dry-bulb temperature and the moisture content by refrigeration at the surface not only involves the construction of an expensive plant, but a large part of the cooling effect produced on the air by the plant is lost before the air reaches the working face where its cooling effect is desired.

Lubricating Hoist Brake Blocks

"Can you tell me what practice should be recommended for lubricating the brake blocks or brake linings of mine hoists? Should they be lubricated and what lubricant should be used?

"One master mechanic whose opinion I value highly stated that it meant a great deal to the life of brake blocks to keep them well lubricated and recommended high-grade steam-cylinder oil. I have talked with officials of other large mining companies who never heard of lubricating the blocks. I might add that one of these companies wears out the brake blocks and brake drums very rapidly.

"Should there be any difference in practice as between a hoist used on the surface and a hoist used underground; or between a hoist used at a metal mine and a hoist used at a coal mine? I ask this question because one company that has never tried lubrication is a large coal company with a great many hoists underground."

We have seen oil used in breaking in a hoist to help attain the proper glaze on the blocks. Also, soap has been used for a similar purpose. Probably most hoists are run dry. However, as there is variety in practice in this connection, *E. & M. J.* will be glad to publish the experience of engineers, giving details as to the kind and quantity of any lubricant used, the frequency and method of application, and the results attained. Letters on the subject suitable for publication will be paid for.

News of the Week

Summary

ALASKA MINERAL PRODUCTION shows slight decline in 1926; successful dredging season at Nome; much prospecting under way.

Expenditures on mine development in Idaho exceeded $8,000,000 in 1925—Page mine on production basis—Work started on Kellogg zinc plant.

Calumet & Hecla robbing backs in old workings—Mayflower-Old Colony continues on mile-long crosscut.

Outside capital sought to revive Australian gold mines; copper producers seek government bounty.

Utah Copper awards medals to twenty-year employees—Tonopah production $144,000 in November.

East Kootenay attracts prospectors — New mining regulations for Panama—Central Manitoba orders 150-ton mill.

Oddie seeks special appropriations to aid research in mining industry—Needs of gold and silver mining cited.

Electrical prospecting stimulates Toronto stock markets — Allenby Copper Corporation dissolved — Silversmith mill temporarily closed.

Climax Molybdenum installs heavy equipment—Horner report on Southern Rhodesia issued in London.

Oliver Iron Mining Co. will open new mine at Chisholm, Minn.

How the Sherritt-Madole Deal Fell Through

Interests Allied With Nipissing Unable to Complete Negotiations—Drop Option But Hold Adjacent Ground

EARLY in 1926 drilling of the Sherritt-Madole property, in northern Manitoba, was begun by interests in the Nipissing Mining Co., who had an option on the property. Since then various statements, which are said to have been more inaccurate than otherwise, have appeared in the press and elsewhere regarding the results. This drilling was done under the direction of W. Lee Heidenreich. The results obtained and subsequent negotiations arising have been reliably reported to be as follows:

About 5,000 ft. of diamond drilling was done and about 500,000 tons of ore blocked out. It is believed that this work has indicated and will make it possible to prove about 4,500,000 tons. Of this amount, about 3,000,000 tons will be on the Sherritt-Madole ground and the other 1,500,000 on adjoining claims which have been purchased or staked for his principals by Mr. Heidenreich.

The oreshoots are about three-fourths of a mile long and 10 or 11 ft. wide. The average value of the commercial ore is 2.86 per cent copper, 3.3 per cent zinc, and less than a dollar in combined gold and silver. These values are decidedly less than those given by H. P. Prather in an article in the *Engineering and Mining Journal* of Dec. 4, 1926. This ore is worth almost the same as the ore of the Flin Flon, but its net value is somewhat less.

The ore was too low in value to make an independent mine so far away from world markets. To make a possible undertaking of the Sherritt property, important concessions were needed from the Whitney interests, who were to build a power plant on the Churchill and reduction plants at Flin Flon, if their present experimental work up there should prove successful. To enable the Nipissing interests to get these necessary concessions, it was necessary to make certain concessions to the Whitney interests, which were willingly made, but it also necessitated that Sherritt and a middle man, Mr. Gordon, make small concessions in their terms to the Nipissing interests. For example, the Whitney people were spending about $800,000 in experimental work on an ore almost identical with that on the Sherritt-Madole, and the Nipissing interests felt that they should not be compelled to duplicate this expenditure and therefore wanted to be able to delay the development of the Sherritt property about two years behind the development of the Flin Flon. To make a reasonable success of the property, mutural co-operation on the part of all concerned was necessary. With Mr. Sherritt it seems there was no difficulty, but it is said that Mr. Gordon and his Toronto associates had formed definite opinions as to the property's value and refused to consider any modifications.

Under these conditions the Nipissing interests could not go ahead and so turned their options back to the Sherritt-Madole owners, retaining, however, the adjoining claims which they had acquired and which contain one-third of the present indicated ore reserves and probably one-half the total ore of the combined properties.

Most mines are generally not quite as good as they look in their preliminary stage of development, but prove to yield a little more ore than one had expected, and it is thought that this will prove to be the fact with the Sherritt property. The Nipissing interests could not figure an interesting profit in the Sherritt property and their own claims combined, except with concessions, and it is not thought that the Gordons now, with only two-thirds of the property and no chance of obtaining the concessions which the other party had obtained, can do any better.

The Nipissing interests, it is said, are standing pat, not particularly interested, but willing to negotiate whenever the Gordons come to their way of thinking. It is reported that the Gordons expect to drill this winter. Under the circumstances this is doubtless agreeable to the Nipissing interests, who would just as soon have them take that chance as to take it themselves.

Mammoth Mining Increased Production in 1926

The Mammoth Mining Co., operating in the Tintic district at Eureka, Utah, has made total dividend disbursements of $3,138,125 from a mine that in its prospect stage was sold by Charles Crismon to the McIntyre interests for a few cattle and small tract of land. Hardly more than two years ago, the Mammoth was considered by most mining men to be a worked-out property, but discovery of a new mineral channel changed the whole outlook.

During 1925 the company produced 22,125 tons of ore, with a gross value of $473,597. This year the output will be 50 per cent larger. In two years the stock has risen from 10c. a share to $2.60.

Georgia Asbestos Mines Sold

The properties of the Asbestos Mining & Manufacturing Co. at Hollywood, Ga., have been acquired by Abb Landis. They will be operated under the name of the "Hollywood Asbestos Mines." New machinery has been installed and improved processes have been perfected.

Alaska Mineral Production Shows Slight Decline in 1926

Much Prospecting and Many Small Developments Under Way—Dredging Operations Show Increase

MINES in Alaska produced $17,490,000 worth of minerals during 1926, compared with $18,220,692 in 1925, according to an estimate just made public by the U. S. Interior Department. Based on surveys of the mineral resources of Alaska by the Geological Survey, the figures show that the amount of gold produced in Alaska increased during 1926 over 1925. The gold output in Alaska in 1926 was estimated at $6,620,000 and was $6,360,281 in 1925.

Production of Alaskan copper in 1926 showed a loss. The amount produced in 1926 was approximately $9,500,000, compared with $10,361,336 in 1925. The output of silver decreased from $482,495 in 1925 to $420,000 in 1926. Coal production in Alaska practically held its own in 1926. Other metals, including lead, petroleum, marble, tin, and platinum, are estimated at $550,000 in 1926, a decrease over the 1925 production, which amounted to $611,963. The total value of the mineral output of Alaska since 1880 amounts to over $570,000,000.

Lode Prospects and Small Mines

A. L. Howard, mining engineer and superintendent of the development on the Kassan Gold Co.'s holdings, Prince of Wales Island, states that the drift on the 300 level is in an oreshoot carrying good values in gold. The Nixon Fork quartz mine, formerly under bond to Treadwell interests, was operated this year. It is equipped with a ten-stamp mill.

Jumbo mine, at Sulzer, Prince of Wales Island, is being reopened, under direction of D. M. Campbell, of Ketchikan.

The Apex-El Nido mine, at Lisianski, has shipped to the Tacoma smelter 50 tons of concentrates of an estimated value of $103 per ton.

On the Hanagita River, near McCarthy, a contact-metamorphic deposit of lead ore has been discovered by J. O'Hara. It lies between limestone and diorite. The ore is steel galena, and has been exposed by development for a length of 300 ft. by a width of 100 ft. Assays show values in gold and silver and about 52 per cent lead. The location is within 8 miles of the Copper River Railway.

The Premier Gold Mining Co., Ltd., operating the Premier mine, at Premier, B. C., which took an option last winter on the Cantou group of mineral claims, after an extensive campaign of disappointing development abandoned the project. The Riverside mine, at Seven Mile. Hyder, has been acquired by E. E. Hall, of the Winnipeg Grain Exchange and a director of the Salmon River Banking Co., of Hyder. R. G. Mellin, mining engineer, has been appointed superintendent. The mill is being operated and is shipping concentrates. Recent surface development has proven for a length of 900 ft. a galena vein 4 ft. wide, hitherto undeveloped. Martin Welch has taken a bond on the Border group at Thirteen Mile and will develop. The Alaska Palladium Co. has ceased operations on the Salt Chuck mine, throwing out of employment about 60 miners, who claim that wages are due them to the amounts of from $100 to $1,400 per man. The Rich Hill mine, at Kassan, Prince of Wales Island, reports that at a depth of 160 ft. the crosscut has encountered a gold-bearing vein. The management expects to crosscut another vein carrying high value in copper at a depth of about 220 ft. The Kassan Gold Mining Co., of which W. J. Elmendorff, of Seattle, is manager, has struck ore assaying upwards of $12 per ton at a depth of 300 ft.

The Jacob Marty mine, at Windham Bay, near Juneau, has been closed down till March, when it is proposed to enlarge the mill. At Mineral Creek, Valdez, the Ethel Mining Co. is driving a tunnel 80 ft. in length, and proposes to install a five-stamp mill. The Hurdle Creek Mining Co., operating in the Teikhel district at Valdez, is producing ore carrying values of $45 a ton in gold, besides silver and lead. A low-level tunnel driven by R. Merrill on the old Brooks property at Port Wells has unwatered the upper level through a raise, and the former reports of rich ore on that level will be investigated. The Little Giant Gold Mining Co. is installing machinery and a tram at the Rose Gold mine.

Successful Dredging Season at Nome

Nome dredges report a successful season, especially those working on Solomon River. The Loman Corporation dredge worked under lease for 111 days, and handled an average of 3,000 cu.yd. of gravel per day. Owing to reconstruction, the Solomon Valley Dredging Co.'s dredge operated only twenty days, but reports good values. This dredge is being enlarged to handle 2,300 cu.yd. per day. The Shovel Creek dredge raised 1,500 cu.yd. per day.

Goldsmith dredge, at Nome, made its trial run on Solomon Creek and recovered gold to the value of $9.500 in ten days. This dredge cost $110,000. The company owns twenty-one claims, with an estimated content of 4,000,000 cu.yd. of an average value of about 60c. The company was organized by the Silversmith interests of Spokane. The Allen Mining Co. reports a successful season with its dragline operations. Hammon Consolidated Goldfields is reported to have made a recovery of gold valued at about $600,000 for the season. The company operated four dredges.

Gold production from Nome for the season is estimated at about $1,750,000, of which nearly half is from the dredges of the Hammon Consolidated Goldfields Co. Otto Halla claims to have discovered the old gold-bearing channel of Anvil Creek.

Golden Center Mines, Inc., of New York, recovered gold valued at $27,700 for twelve days' run with its No. 1 dredge. The average value of the gravels is stated to be $1.30 per cubic yard. The company's holdings are on Candle Creek. It intends building and operating other dredging plants.

The Golden Center Company is arranging to use the lignite coal deposits of Candle Creek for generating electric power for its two dredges.

In the Council district the Northern Light Dredging Co. worked 117,000 cu.yd. of low-grade ground. Rock and Aggie creeks are attracting the attention of prospectors, owing to a good strike made during the summer.

The Dime Creek Dredging Co., operating on Dime Creek, Seward Peninsula, ran only twenty-five days, but obtained a surprisingly good clean-up. The short season was attributable to want of water for thawing. The Porter, Leonard, and Olsen hydraulic plants were profitably operated. The Smith mine, on Sweepstakes Creek, gave good returns. A new hydraulic plant is being placed on this creek by F. McCoy. The creek is stated to carry commercial gravels for a length of 30 miles.

Dredging in Interior Alaska

Owing to abundance of water during the past summer the production of gold from Forty Mile will be double the average of recent years.

Tanana Gold Dredging Co. of London, England, has put a 5-cu.ft. dredge on Fish Creek, in the Fairbanks district. The Fairbanks Exploration Co. expects to complete its big ditch by the spring of 1928. This company's drilling operations on C'eary Creek have disclosed an old channel, and also bench ground on the same creek, both carrying good values.

The Nome Creek Dredging Co., of Fairbanks, successfully launched the first dredge to be electrically operated in the interior. Nome Creek, Chatanika, where the company has its holdings, does not require thawing, this being done by the natural seepage. The ten-stamp mill is being moved from the Chena to the Ester-Dome mine, on the Alaska Railway. The vein is 6 ft. wide, and its value is stated to be $50 a ton in gold.

Iditarod's production will be less than usual, owing to shortage of water experienced during the season. Willow Creek will probably have a record production from the Willow Creek, Fern Gold, and Mable mining companies. Alaska Minerals Co. produced ten tons of concentrates from its gold-quartz mine on Palmer Creek, 12 miles from Hope. The mine is equipped with a five-stamp mill.

Testing the gravels of Mills, Cottonwoods, and Pass Creeks, at Fairview, has given an average of 60c. per cubic yard, to a depth of 9 ft. and for a width in the channel of over 100 ft.

The American Creek Dredging Co. is being organized to operate a dredge on American Creek, in the Hot Springs district, where it controls 4½ miles of channel, estimated to contain 2,000,000 cu.yd. of an average value of 95c. The pay gravels have a width of 200 to 300 ft. and an average depth of 13 ft. The ground has to be thawed.

Hydraulic Mining Operations in Alaska

The Detroit Mining Co. has got most of its hydraulic equipment as far as Bettles and Coldfoot on the Koyukuk River, and expects to be in readiness by next spring to start work on a ditch about 45 miles in length to bring water from the Koyukuk to Hammond River, where the company plans to operate.

E. A. Head has taken an option on the holdings of the Gold King Mining Co., in the Bonnifield district, Fairbanks, with a view to installing a larger hydraulic plant. The gravel is said to average 50c. per cubic yard.

J. C. Murray, who acquired the property of the Cache Creek Mining Co., has installed a hydraulic plant below the confluence of Cache Creek with Rambler Creek to work the bench gravels. He reports a good season, not only for his own ground but for the district generally. His operations stripped 140,000 sq.ft. of bedrock for the season. A 1,000-ft. ground-water ditch was constructed. Mr. Murray is purchasing another hydraulic plant for extension of his operations on Cache Creek. On Nugget Creek 160,000 sq.ft. of bedrock was uncovered, and produced some rich gravel. The latter camp has the advantage of an abundant supply of lignite coal.

On Big Hurrah Creek, the hydraulic plant near Nome, operated by E. W. Quigley, moved 20,000 cu.yd. of gravel during the season.

Dan Creek Hydraulic Mining Co. has changed its name to Nicolai Placer Mines Co., with headquarters at McCarthy.

Ditch Construction at Fairbanks, Alaska

Rapid progress is reported on the 74-mile ditch by the Fairbanks Exploration Co. during the season of 1926. Extensive use of heavy graders pulled by ten-ton tractors and of steam and Diesel shovels resulted in pushing this construction work ahead of schedule. The company also completed, at Fairbanks, a modern office building of concrete-block construction, and work was begun on a central power plant which is expected to cost about $1,700,000. This company expects to spend about five million dollars before getting into production. It plans to have two dredges at work during the summer of 1928. According to conservative estimates the placer reserves blocked out and proven under this project total between fifty and ninety million dollars.

Alaska Plane Carrying Gold Falls Into Kuskokwin

Joe Crosson, pilot, and Charles Salami and Carl Carlsen, miners, were nearly frozen to death when an airplane in which they were flying fell into the Kuskokwin River at McGrath, Nov. 11, with a cargo of gold dust estimated at 300 lb. and valued at approximately $90,000. The temperature was below zero and the river was running full of ice. The men were saved after waiting more than an hour on the wings of the plane.

Black Hills Activities

The Spokane Lead Co., Keystone, S. D., has resumed operations after an idleness of eight years, and in addition to considerable mine development, with lower depths, has also repaired the 100-ton concentrator and will begin milling silver-lead ores soon after the first of the year. Additional equipment has been installed at the mine.

John Bland and associates have taken over the old Tinton Tin property at Tinton, and extensive plans have been made for continued operation. The old milling plant is being dismantled and will be replaced by a plant of 100 tons' capacity, with modern machinery for the recovery of both the tin and mica.

Mine Development Expenditures in Idaho

THE amount of money expended in mine development in Idaho in 1925, by non-producing, producing non-dividend paying mines and for assessment work is given by the Idaho Mining Association as follows:

Labor	$5,214,631
Supplies	2,319,442
Mine equipment	305,542
Mill equipment	179,818
Power plants	98,750
Tramways	4,000
Ore transportation	561,370
Total, 1925	$8,683,553
Total, 1924	6,267,908

These figures represent 7,759 unpatented mining claims owned by individuals; 2,468 new mining claims located by individuals, and 602 companies employing 2,976 men. It is estimated that 95 per cent of this money was obtained from "absentee owners."

Many Claims Located in East Kootenay

The year 1926 has been one of unusual activity in mining in the Kootenays, particularly in East Kootenay, comprising the districts of Cranbrook, Columbia, and Fernie. There has not been, even in the boom days of 1898, such a general movement of prospectors into the hills as has obtained here within the last twelve months. The following figures are taken from records of the mining recorder in Cranbrook.

Locations	792
Certificates of work	900
Free miners' certificates	326
Certificates of improvements	59
Crown grants	29

The above would indicate that the hopes of prospectors are centered in East Kootenay—more especially so when it is noted that areas that have hardly known the impress of a human foot in years are now being combed by an entirely new crop of prospectors, and old locations, long abandoned, have been restaked by their former owners, who have returned.

Calumet & Hecla Robbing Backs in Old Workings

Calumet & Hecla Consolidated is mining rich ground in its famed conglomerate lode at Calumet, Mich., at a point 1,800 ft. north of Calumet No. 6 shaft on the 48th level. This is the farthest north that the formation has been opened. Drifting north also is proceeding on the 33d and 35th levels. Rich ground also is being mined in the sub-shaft under Tamarack Junior territory. Meanwhile, exceptionally good copper rock is being taken out of backs of old stopes in conglomerate shafts. In No. 6 Calumet, old backs are being mined from the 29th to the 36th levels. No. 2 Calumet shaft is in slow process of abandonment, producing about 300 tons per day from old backs between the 18th and 27th levels. It will take about five years to exhaust the available ground in this shaft.

New Mexico Manganese Shipments 200 Tons per Month

The only manganese production in New Mexico comes from the Warren and Hoagland mine, situated in the Little Florida Mountains, about 12 miles southeast of Deming. Thirty-five men are working under leasers. The milling process consists of crushers, followed by jigs, turning out a product that assays from 45 to 48 per cent Mn. Shipments average about 200 tons per month.

It is estimated that 35,000 tons of ore is blocked out in the mine.

Mayflower-Old Colony Continue Pioneer Project

Mayflower-Old Colony's exploratory program is considered of much importance to the Michigan copper district. It is crosscutting through a wide belt between No. 8 conglomerate and the Kearsarge amygdaloid, the first opening of the kind in this extensive territory and a pioneer project in every respect. Arcadian has done a small amount of exploratory work in a part of this area, but only on one vein. Only the eastern part of this horizon has ever been mined, such operations being confined to Champion, Baltic, and Isle Royale. The crosscut is now more than 2,600 ft. in length, about halfway to the Kearsarge. No copper has been encountered since the cutting of the St. Louis amygdaloid.

New Mining Regulations for Panama

All persons holding titles to mines in Panama must file with the Secretary of Agriculture and Public Works, before Jan. 1, 1927, certain stipulated data, according to advices received in the U. S. Department of Commerce from George C. Peck, U. S. Commercial Attaché, Panama. This data includes (1) a duly legalized title; (2) proof that the title has been properly registered; (3) proof of payment of annual tax required by the fiscal code; (4) proof of payment according to Article 63 of the governing statute, 1904.

Washington Letter

By Paul Wooton
Special Correspondent

Special Appropriations to Aid Mining Industry Sought by Senator Oddie

Immediately on the reconvening of Congress the Senate Committee on Mines and Mining was asked to authorize the following appropriations: Geophysical prospecting, $25,000; economic studies of iron, $20,000; economic studies of gold and silver, $20,000; replacing mine rescue car, $45,000; replacing of obsolete oxygen-breathing apparatus, $10,500; for the testing of electrical equipment for permissibility, $15,000; for the testing of explosives used in metal mines and quarries, $10,000.

One of the rescue cars of the Bureau of Mines can be used no longer because of the refusal of the railroads to handle it. The car was built prior to 1880, and is in such a dangerous condition that it cannot be moved with safety. There also is urgent need for fifty sets of improved breathing apparatus.

For many years it has been recognized that faulty electrical equipment in gaseous mines is a serious hazard. Studies of this subject, Senator Oddie believes, will have an important effect on safety.

Accidents from misfires of explosives used in metal mines and asphyxiations from the fumes of explosives could be reduced, it is believed, by studies of the explosives used for those purposes.

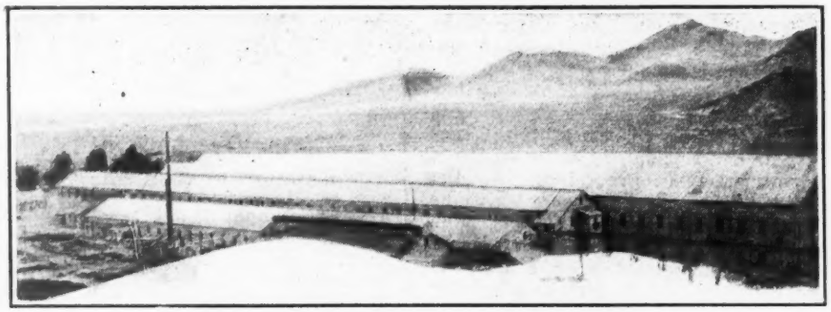
Senator Oddie, the chairman of the committee, expects to appear before the Appropriations Committee to urge that the Commerce Department appropriation bill be amended so as to carry these additional amounts.

The budget has allowed $30,000 for additional economic studies by the Bureau of Mines. This entire amount, however, will be necessary to take care of the work already planned on copper, lead and zinc. The increase is being asked so that statistics may be gathered concerning the production, consumption, and stocks of these metals. In addition, there will be studies covering the marketing problems of those commodities.

Both gold and silver, Senator Oddie will point out to the Appropriations Committee, are confronted by emergencies. The cost of producing gold has risen steadily, and since these costs cannot be passed on, the industry is declining. There is the greatest need, he will contend, for economic studies covering the problems of that industry. The emergency in silver is even more acute, owing to events in India and China. Since much of the copper production of the United States is made possible by the recovery of silver and gold as byproducts, there is the greatest need to study the economics of the situation confronting the industry, which must be ready to meet competition from the African deposits now being developed.

With the depletion of the richer deposits of iron ore, economic studies are becoming more and more necessary. Despite the importance of this raw material, much of the important information having a bearing on the situation is in the hands of individual companies that naturally are not making it available to their competitors.

In view of the very large expenditures which the federal government makes on economic studies in connection with agricultural commodities, Senator Oddie will urge that some start be made toward a more generous attitude toward the mining industry.



Mill of Tonopah Mining Co. at Millers, Nev.

Tonopah Production $144,000 in November

Production of the Tonopah district in Nevada for November was valued at $144,000, which is slightly less than October production, as a result of shutdowns on account of heavy storms, which interfered with electric power lines. The Tonopah Mining Co. shipped bullion valued at $76,000, which included production from the Tonopah Belmont Development Co., miscellaneous custom ore, and Tonopah Mining Co. ore; the West End company shipped $35,000, and Tonopah Extension $33,000.

The Tonopah Mining Co. reports the discovery of a faulted segment of the highly productive Valley View vein, on the 650 level, and Tonopah Extension the discovery of a new vein in the extreme westerly workings on the 1,540 level from the McCane shaft.

Page Mine on Production Basis

The Page mine, formerly known as the Corrigan, has been added to the long list of mines owned and operated by the Federal Mining & Smelting Co., Wallace, Idaho. A flotation mill for the recovery of both lead and zinc, having a daily capacity of 250 tons, began operation on Dec. 8. There is a large developed ore tonnage, and as the ore responds readily to milling treatment, it is probable that the mill will soon be handling more than its rated capacity, possibly 300 tons per day. The Page is a striking example of the remarkable results accomplished by differential flotation in the treatment of lead-zinc ores.

After sinking a shaft 600 ft. and exploring the vein, the Federal company abandoned the Page about fifteen years ago for the reason that the high percentage of zinc associated with the lead made it necessary for the smelters to impose a penalty so high that there was no profit in shipping the lead. The mills of that time were of the gravity concentration type, and necessarily much of the zinc remained in the lead concentrate. With the remarkable advance in the development of the flotation process, the Federal company some two years ago reopened the old Page mine and carried out an extensive plan of development. Mill tests of the ore proved a perfect separation of the lead and zinc by differential flotation, and this was followed by the construction of a modern mill and the entrance of the Page into the list of shippers.

Utah Copper Awards Gold Medals for Long Services

Gold medals were awarded to sixteen employees of the Utah Copper Co. and the Bingham & Garfield Railway Co. for twenty years of loyal service at a dinner held on Dec. 17 at the Hotel Utah, Salt Lake City. Those receiving medals donated to D. C. Jackling, president of the Utah company, included all ranks of employees from J. D. Shilling, mine superintendent, and superintendents of other departments down to foremen, office men, and a watchman. Awards were made in the absence of President Jackling by L. S. Cates, vice-president and general manager, to Dr. A. L. Castleman, John H. Cash, William J. Brown, John Steele, A. C. Ensign, O. A. Sonne, John Loutensock, Fred Barton, C. B. Ashby, Thomas Caulfield, John Marlor, Sr., J. D. Shilling, Peter Fisher, David Barclay, Marcus Roudebush, and Evan Jones.

These men have seen the gigantic Bingham enterprise grow from a prospect to a mine with a record of nearly $150,000,000 in dividends. They aided in the development of a type of operations which have had a more far-reaching effect upon mining the world over than any other method ever conceived.

Central Manitoba Orders Mill

Henry Hanson, formerly of Dome Mines, has designed the new mill which will be erected on the Central Manitoba Mines and for which orders have already been placed. It is understood that Mr. Hanson spent considerable time at the Temiskaming laboratories making tests of the Central Manitoba ore so as to determine the proper treatment necessary for the best extraction.

The new 150-ton mill is to be taken into the camp over the winter roads and should be ready for operation by midsummer. Contracts for mill machinery and equipment have been placed.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Electrical Prospecting Stimulates Toronto Stock Markets

During the last week million-share days on the Standard Mining Exchange of Toronto have been common. Interest has been centered largely on the Quebec stocks, principally Area and Amulet, which are waiting the confirmation or otherwise of ore areas indicated by electrical prospecting. These indications are the most promising yet found in the Quebec field, except on properties with proven orebodies, and the possibilities that they indicate copper are considered to be very good. Zinc blende has approximately the same electrical resistance as barren ground and would not be expected to give pronounced indications. The dip needle shows very little reaction, so the occurrences are not believed to be pyrrhotite. Large bodies of barren pyrite have not been found in that section, so by a process of elimination the conclusion that large bodies of copper ore will be found seems tenable.

Public interest has been aroused to a surprising extent, resulting in a gambling fever and large bets in the stocks. Men who ordinarily have little to do with mining are speculating wildly in these two stocks, and within the next two weeks a lot of money will have been made or lost. It is believed that the orebodies lie close to the surface and are covered by about 20 ft. of overburden. A drill is now being moved to the ground and results should be known about the time this issue of *Engineering & Mining Journal* appears. Electrical prospecting has taken a strong hold in Quebec, and sufficient equipment and trained men to handle the work are not available.

N. A. Timmins, Inc., controls the Waite-Montgomery and the Alderson-MacKay and has a large interest in the Amulet. Plans are being discussed covering the erection of a central concentration plant for these three properties, the probable location being on Lake Dufault. Each company would own an interest in the plant, which would produce copper and zinc concentrates. The former would go to the Noranda smelter and the zinc concentrates would be shipped abroad. At the Waite-Montgomery the only work going on at present is diamond drilling. It is not considered necessary further to develop the big orebody, which will be opencut following the removal of the overburden by steam shovel.

Early in the new year the Mining Corporation of Cobalt will send men into Montbray Township, in northwestern Quebec, where it holds a large acreage. A complete survey will first be made and it is expected that in February a campaign of electrical prospecting will be started. A few days ago electrical surveys were started on both the Duprat and the Laval-Quebec properties.

The Consolidated Mining & Smelting Co. of British Columbia has dropped its option on the O'Leary claims in Duprat township. Work done to date has given meagre results, and as a payment was due and the vendors would not extend the payment date, the company did not feel justified in going ahead.

A good deal of staking has been done in Munro Township since the recent discovery of copper and zinc on the R. S. Potter properties. Surface operations are slow on account of winter conditions, but the discovery is reported to be a very promising one.

Hauling Heavy Equipment at Climax

During last summer the Climax Molybdenum Co., operating a low-grade molybdenum mine at Climax, Lake County, Colo., increased its plant capacity from 550 to 800 tons per day. This increase was accomplished by adding a 36x24-in. Allis-Chalmers jaw crusher, a set of 54x20 in. Garfield rolls, and a 6x10-ft. ball mill.

The crushing plant is at the mine, one and a quarter miles from the railroad and 900 ft. higher, at an elevation of nearly 12,000 ft. above sea level. The road to the mine is rough, with many sharp curves and grades running up to 24 per cent, making the use of horses and mules for pulling the heavier pieces almost impossible. The heaviest piece of the crusher weighs 18 tons, two pieces of the rolls weigh 14 tons each, and four pieces weigh 10 tons each. There were a number of lighter loads ranging from four to six tons, but these presented little difficulty.

Transporting heavy crusher from railroad to Climax mine

For the heavy hauling a strong wagon, with a capacity of 40,000 lb., was purchased and three five-ton Coleman trucks were rented. As can be seen in the picture, the loads were placed on the wagon and the trucks, loaded with cement, were placed in tandem, all hauling together. In places the road was very soft, and a number of times one of the wagon wheels dropped down to the axle. However, quick work of rigging top lines saved a wreck each time, the wagon was jacked back to level, and a crib built to carry the load on the soft side. The entire equipment, weighing a little over 100 tons, was transported without a mishap.

National Tin to Start Work Soon

The National Tin Corporation, Hill City, S. D., will begin mining east of the company's mill on a body of gold ore three feet wide and 300 ft. long, on which a shaft has been sunk. It is planned to treat this ore on the company's properties and increase the working force as the operation progresses.

Golden Mary Mine Constructs Tramway

Machinery and an aërial tramway used in operating the state limestone plant at Gold Hill, Ore., are being reconstructed on the Golden Mary gold mine, 6 miles out from Grants Pass. The tramway will be a mile and a quarter in length and crosses three canyons in conveying the ore from the mine to the mill. The reduction plant is of 100-ton capacity. Power and lighting will be supplied by Diesel engine. P. X. Johnson, Grants Pass, is engineer in charge.

Black Forest Ships 35 Tons Daily

Shipments from the Black Forest mine, in the Spruce Mountain district, twenty-five miles south of Tobar, Nev., are averaging around 35 tons daily. Discoveries of bedded and fissure deposits on, above, and below the main tunnel level south of the old stopes have greatly improved the outlook for the mine. The carbonate ore ranges from $1,800 to $2,000 a carload after smelter and railroad deductions.

Standard Silver-Lead Options Red Top Group

The Standard Silver-Lead Mining Co. has made an initial payment of $10,000 toward the purchase of the Red Top group, formerly called the Richfield group, eight miles from Topley, B. C., and has men at work, getting things ready for active development. A gasoline compressor, hoist, and pump have been shipped to the property from the

Standard mine, at Silverton. The consideration to be paid for the property is $200,000, payable over two and one-half years; the second large payment falls due in one year, but the company has agreed to pay F. H. Taylor, the owner, $300 per month until the second payment is made, the monthly payments going toward the final payment in the event of the option being exercised. The Red Top group has created more interest than any other prospect in British Columbia. Since its discovery, last spring, hardly a week has passed without an engineer representing some prominent company visiting the mine. The deposit is 150 ft. wide and consists of a mineralized zone containing lenses and stringers of pyrite, arsenopyrite, and galena, with which are associated important gold and silver values.

Work Started on Million-Dollar Zinc Plant

A letter to the stockholders of the Hecla Mining Co., Wallace, Idaho, from L. E. Hanley, secretary of the company, formally advises them of approval of construction of the electrolytic zinc plant at Kellogg by the Sullivan Mining Co., owned jointly by the Hecla and Bunker Hill & Sullivan companies. Work on the plant has been started and it is estimated that it will be completed in a year. Mr. Hanley states that: "The operating profits of the Sullivan Mining Co. (Star mine) are applied on the purchase price of the property and will be so applied under present prices and conditions for several months. Under this situation the Hecla company will be required to furnish one-half of the cost of the zinc plant, or from $625,000 to $750,000 in the next year. It will be the policy of the board of directors to pay this charge from the surplus earnings; if no surplus earnings, then from accumulated surplus, and lastly with borrowed money. This last contingency is remote. It will also be the policy of the directors to continue the present dividend payments, if earned, but not to apply any substantial amount of accumulated surplus for dividend purposes."

This letter accompanied dividend checks for the last quarter, which were at the rate of 50c. per share, amounting to $500,000. The company has paid an even $2,000,000 in 1926.

Incline-Raise System Producing Big Tonnages

Developments in drawing-off methods of the incline-raise system have resulted in a marked increase in tonnage for several of the large porphyries. Notably among these is Miami Copper, which has increased its tonnage from 10,000 to 12,000 tons a day. At Inspiration the tonnage has been increased from 18,000 to 22,000 and on occasions to approximately 24,000.

As there is a very slight increase in the number of men necessary to produce these larger tonnages, the costs are remarkably low, Miami's being said to be approximately 34c. a ton, including delivery to the mill bins.

London Letter

By W. A. Doman

Special Correspondent

Horner Reports on Southern Rhodesia Copper Holdings —Reserves Large

London, Dec. 14—The event of the week is the issue of the report of P. K. Horner on the properties of the Southern Rhodesia Base Metals Corporation. This document has been talked about for weeks, and according to rumor it was to be of a favorable nature. It certainly is, and is of the greatest importance, not only to Rhodesia but to the copper supplies of the world. Not that the latter will be increased by Southern Rhodesia immediately, but the potentiality is something to be kept in mind. The area round the Copper Queen and Copper King properties is bounded by a circle of 15 miles' radius, with a central point at the junction of the Umniati and Umfuli rivers. No fewer than 65 orebodies are known to exist and 34 blocks of claims have been marked out, a block of gold claims having an area of 900,000 sq.ft., and a block of base-metal claims, 2,700,000 sq.ft. The Copper Queen and Copper King contain copper, lead, and zinc ores, and, says Mr. Horner, "there is no doubt that something like 19,000,000 tons of oxide ore exist in these groups —that is, considering the depth of oxidation to be 100 ft. on all the orebodies, which assumption is in accordance with the information available to date." Making very substantial allowances, the indicated sulphide tonnage is something like 2,500,000 tons per 100 ft. of depth.

The sulphide ores are to be treated first, by the Minerals Separation differential-flotation process, to produce lead concentrates containing about 60 per cent of lead, copper concentrates containing about 20 per cent of copper, and zinc concentrates with about 45 per cent of zinc. A 1,000-ton per day unit to start with is recommended.

Though the Russo-Asiatic Consolidated and the Russian Mining Corporation are unable to recover their properties from the Soviet Government, this same authority has granted to the Tetiuhe Mining Corporation, Ltd., a concession over certain mining claims and land in the Primorsky district of Russia. The Tetiuhe concession consists of lead, silver, and zinc mines about 24 miles west of Tetiuhe Bay, which is 230 miles north of Vladivostok. Royalty payable to the government fluctuates between 3.5 per cent and 6 per cent for concentrates, and between 3 per cent and 4.5 per cent for metals produced. Holders of this concession are obliged to erect a lead smelter of a capacity of 3,000 tons of lead per annum. The concession is for thirty-six years, with pre-emption right on the part of the government at the end of the first twenty-five years.

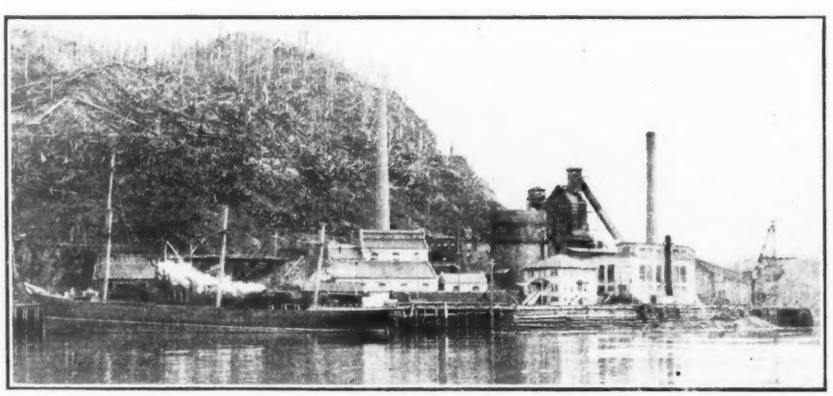
It is interesting to note that the first company to go into Nigeria in search of tin has just been put into liquidation. Mr. Champion formed the Champion Gold Reefs of West Africa, in 1909, and, meeting with little success in this direction, went further afield for tin, the discoveries of his company leading to the subsequent invasion of the country. The Champion company acquired properties and floated the Naraguta (Nigeria) Tin Mines, the Lucky Chance Mines, and Tin Fields of Northern Nigeria. Though the Champion Gold Reefs was not a success, it played in some ways a useful part.

Oliver to Open New Iron Mine at Chisholm

The Oliver Iron Mining Co. soon will open a mine in the Chisholm district on the Mesabi range, Minn. It will be one of the largest underground producers on the Mesabi range, hoisting ore not only from the Burt property, on which it is located, but also from the adjoining Glenn property. It will be electrically operated.

Allenby Copper Corporation Dissolved

The Allenby Copper Corporation has been dissolved, and H. L. Plommer, comptroller for the Granby Consolidated Mining, Smelting & Power Co., has been appointed liquidator. This news is not as ominous as it sounds; it simply means that in the future the operations of the Allenby corporation at Copper Mountain and Allenby, in the Boundary district of British Columbia, will be carried on under the Granby company's name. No changes will be made in the staffs at either mine or mill.



Byproduct coke plant, Granby Consolidated Mining & Smelting Co., Crow's Nest Pass, B. C.

Johannesburg Letter

By John Watson
Special Correspondent

Platinum Recovery Subject of Further Research—Oil Shale May Be Source of Motor Fuel

Johannesburg, Nov. 23. — Northern Platinum Exploration, Ltd., held its annual meeting in Johannesburg on Nov. 12. F. R. Lynch, chairman of the board, said the method of extraction of platinum from the sulphide and oxidized ores was not yet far advanced, though encouraging results had been obtained from a flotation test on the sulphide ore, which showed that 88.9 per cent of the platinoid values were collected in a concentrate of very small bulk. The question of erecting a pilot plant would come up later for consideration. Cost balance and assets amount to £195,322. The company has abandoned its option on Umkoanesstad. Zekoegat is looked upon as the farm on which the future of the company mainly depends; 330 ft. sampled there gave an average value of 4.2 dwt. over 61 in.

The metallurgical problems of platinum recovery are discussed in the latest number of the *South African Mining and Industrial Magazine*. Though the recovery of platinum from dunite at Onverwacht is successful, no system or method has yet been devised to recover platinoids from oxidized norite. In the case of norite sulphides, experiments carried out by Minerals Separation, Ltd., with froth flotation have given promising results. Transvaal Platinum, Ltd., had brecciated quartzites and felsites and, in some cases, much specularite, associated with the platiniferous ore. The method used at Onverwacht does not meet Waterberg requirements and the plant near Naboomspruit has been shut down. In the early years of Rand gold extraction the cyanide process was not used and a further period of some years elapsed before go'd was recovered from the slime portion of the tailings. Further experiments and researches are to be carried out on methods of platinoid recovery.

Transvaal Consolidated Land Co. issued its quarterly report on Nov. 19. Encouraging platinoid values are disclosed on Farm Middelkraal No. 358, Brakspruit No. 393, and Boschkoppie No. 685, in the Rustenburg district. Prospecting operations are being continued on the Farm Der Brochen No. 1,158, which is in the Lydenburg district.

South African Oil Shales To Be Studied

Dr. Hans Merensky, who recently visited Germany, has been interviewed by the commercial representative of *The Star*. While in Europe on holiday Dr. Merensky inquired into the latest deve'opments in the recovery of oil from coal and lignite. South Africa imports oil to the annual value of £4,000,000, but she has deposits of torbanite and bituminous coal which should be highly suitable for the production of oil and petrol. Ploughing by motor tractors instead of oxen would revolutionize farming in South Africa. A German expert is visiting this country to make inquiries, on the spot, as to the suitability of our torbanite and oil shales. If this decision is favorable, £2,000,000 capital is available from a powerful German bank to finance the undertaking.

Project to Place Honduras on Gold Basis

The Government of Honduras has under consideration a project for restamping the silver coins in circulation in the country and for making only restamped coins legal tender, according to the Division of Regional Information of the U. S. Commerce Department. The object of this restamping is to ascertain the amount of sliver in circulation in the republic and ultimately place the country on a gold basis.

Silversmith Mines Mill Temporarily Closed

Silversmith Mines, at Sandon, B. C., has closed its mill, and has announced its intention of holding its ore reserve for a better market. During the mid-winter months, owing to the freezing of the creeks from which the company derives its power, there is not enough power to operate the mining plant and the mill, so an auxiliary Diesel engine plant has to be put into operation if the mill is run at anything approaching its capacity. This naturally increases the cost of the production of silver-lead and silver-zinc concentrates.

Development of the mine, which is said to have fallen behind, will be continued. Diamond drilling is reported to have indicated several new bodies of ore, and these will be opened up and the existing oreshoots will be developed at greater depth while the mill is idle.

Satisfactory Development Work at Cortez Mine

Reports from the Cortez mine, in Nevada, owned and operated by the Consolidated Cortez Silver Mines Co., indicate normal operations. The drop in the price of silver has made it necessary to abandon most of the old fills in the mine as too low grade to pay, but mine developments have been very satisfactory, and the concentrating-cyaniding plant is handling an average of 140 tons of ore per day.

Recent developments in the lower levels of the mine may result in a change in milling practice, from table concentration to flotation.

International Smelting Buys Potosi Mine

The Potosi mine, Goodsprings, Nev., formerly owned by the Empire Zinc Co., a subsidiary of the New Jersey Zinc Co., has been purchased by the International Smelting Co. For the present, the International Smelting Co. plans to withhold development until such time as there is a more immediate need for zinc ores.

Melbourne Letter

By Peter C. Tait
Special Correspondent

Additional Capital Secured for Australian Mines—Copper Producers Seek Bounty

Melbourne, Nov. 29—Several important transactions involving the introduction of capital from overseas for Australian mines have been concluded during the last few weeks. The Anglo-American Corporation of South Africa, which holds large interests in South African diamond, gold, copper, and silver-lead mines, has subscribed for 50,000 shares in Mount Isa Mines, Ltd., and, subject to satisfactory reports from engineers who are being sent out to report on the properties, has the right to subscribe for an additional 550,000 shares. As there are only 159,820 unissued shares, the capital of the company is being increased to £1,500,000 by the creation of 700,000 new shares of £1 each. The other company which has been successful in obtaining the necessary capital is the Federation Tin Mines, Ltd., which has been floated in London with a nominal capital of £200-000. This mine is at Heemskirk, near Zeehan, on the west coast of Tasmania. It has been brought to its present stage of development by a local company under the management of J. B. Lewis, formerly general manager of the Anchor tin mine. According to his report 60,000 tons of 1 per cent ore has been proved, and he estimates that 1,000,000 tons is available. A treatment plant has been acquired. The new company will have £60,000 available, and it is expected that the plant will treat 120,-000 tons per annum. If the price of tin holds between £250 and £300 per ton good profits should be earned.

Australian copper producers are following the lead of the gold producers in seeking a bounty on production. Their complaint is that the low market price does not cover the cost of mining and treatment. Copper is an essential commodity, and under present conditions the industry is languishing. Practically speaking, the Mount Lyell is the only company operating on a reasonable scale, and the interests which that company holds in the fertilizer business are believed to contribute in no small measure to its commercial success. Both mining and refining interests are behind the present movement. The mines ask for a premium of £10 per ton on all copper produced while the price of standard copper remains less than £66 a ton, the premium to decrease by £1 a ton for each £1 increase in the price. In addition to the bounty to the mines, the refiners are asking assistance to the extent of £2 10s. a ton on an output of under 7,000 tons, and lesser amounts as the output exceeds that figure. The refining company is asking for this bounty notwithstanding the fact that there is a duty on copper imported from overseas and the local producers are enabled to sell refined copper at an advance on the world's market price. No decision has yet been given by the tariff board.

Societies, Addresses, and Reports

Lead Smelting Progress Reviewed at A.I.M.E. Meeting in Salt Lake City

The November meeting of the Utah section of the American Institute of Mining and Metallurgical Engineers, which was devoted to the discussion of ore treatment methods, drew the largest attendance of any recent meetings. W. Spencer Reid, metallurgist at the Murray smelter, in his paper on the "Progress of Lead Smelting During the Last Five Years," stated that actual blast-furnace practice today is slightly if any better than it was five years ago, although it is immeasurably better than it was twenty or thirty years ago. Notwithstanding the dwindling of supplies of ideal smelting ores, by using a greater volume of air and heavier pressure the total blast-furnace charge has been increased.

"The metallurgist of a generation ago," said Mr. Reid, "did very good work considering the equipment he had available. It is true he was working with the cream of the ores, the clean oxides and carbonates and the low-zinc sulphides. He was troubled very little with high zinc, and selected his type of slag according to preference of some authority such as Eilers, Iles, Rathon, or Hahn. As these free-smelting ores were depleted the complex ores were encountered, and the metallurgist gradually discovered that he had to forget the old-type slags and run a slag according to the percentage of zinc on the charge. I believe it is now universally agreed that silica and calcium oxide must be lowered and ferrous oxide raised in a slag as the zinc oxide increases. The ratio of these variations is practically uniform and can be relied upon over wide fluctuations of the determining element, zinc. These bastard slags, as sometimes inappropriately referred to, are actually in daily use, and the metallurgist of today has been forced to adopt certain standards as a guide to successful operation. These slags practically route the old Eilers' theory that all good slags are chemical combinations of SiO_2 with FeO, MnO and MgO. Eilers' theory and other type-slag theories were based upon the assumption that a good slag must conform to definite formula, such as:

$3\ (FeO)_2\ SiO_2 + 2\ (CaO)_2\ SiO_2$
or $2\ (FeO)_2\ SiO_2 + 2\ (CaO)_2\ SiO_2$
which respectively figure 31.3 and 36 per cent SiO_2. The SiO_2 was supposed to remain constant even with the entrance of impurities such as Zn and Al_2O_3, into the slag. The increasing amount of impurities, especially Zn, soon discredited the theory, for in practice the slag failed to run freely.

"The lead metallurgist of today has learned from actual experience that he must vary the analysis of his slag for every appreciable change in zinc content. W. W. Norton has made up a tabulation of slags based upon actual successful operation at the widely scattered plants of the A. S. & R. Co. This table is founded on the predominant case where the values are in the silica, with the resultant object of running as high SiO_2 and as low FeO as possible, and at the same time taking into consideration the satisfactory operation of the furnace as regards speed and reduction. He has given a very appropriate title to his tabulation and modifies the list with the statement that it 'represents a commendable degree of economy of iron, and that any metallurgist who succeeds in keeping his tuyères open and his furnaces in good shape with these slags, may be considered as doing splendid work.' Mr. Norton's tabulation, based on per cent of zinc in charge, follows:

Standard of Lead Furnace Slags of 1925

Zn in Charge Per Cent	SiO_2 Per Cent	FeO+ MnO Per Cent	CaO+ MgO Per Cent	ZnO Per Cent	Total Per Cent
0	41.0	25.5	28.5	0.0	95
1	39.7	26.75	27.3	1.25	95
2	38.4	28.0	26.1	2.5	95
3	37.1	29.25	24.9	3.75	95
4	35.8	30.5	23.7	5.00	95
5	34.5	31.75	22.5	6.25	95
6	33.2	33.0	21.3	7.5	95
7	31.9	34.25	20.1	8.75	95
8	30.6	35.5	18.9	10.0	95
9	29.3	36.75	17.7	11.25	95
10	28.0	38.0	16.5	12.5	95
11	26.7	39.25	15.3	13.75	95
12	25.4	40.5	14.10	15.00	95

"This list is based on the assumption that constituents other than those listed such as Al_2O_3, BaO, Pb, Cu, S, etc., total 5 per cent, and does not attempt to cover special cases such as high alumina slags. If unusual amounts of Pb, S, etc., enter the slag, it is only necessary to cut the SiO_2, FeO and CaO in equal proportions.

"The above tabulation is absolutely feasible and makes a good standard to 'shoot at.' With fast driving furnaces and ideal charge conditions, it is practical to exceed the above list to a considerable extent. At Murray an average total of 40.5 per cent SiO_2 + Zn (5.1 Zn) on the regular lead charge and an average total of 44.5 per cent SiO_2 + Zn (4.0 Zn) on the copper concentrate charge, for periods of over a month's duration have been exceeded.

Selective Flotation

"The height of high zinc slags probably was reached in 1924 and 1925. About that time the development of selective flotation and its successful application to lead, zinc and iron ores began taking the zinc away from the lead smelter. This turned the slag-zinc curve downward, decreasing the troubles of the blast-furnace operator, but materially increasing the troubles of the roaster operator. The statement that the production of flotation concentrates lowered the zinc in lead slags may prove only temporary. If selective flotation is developed to a point where all sulphide ores are treated, it may prove the reverse. Slag-forming material in the concentrates may be so low that the ratio of zinc to SiO_2 may possibly be higher than it was in the original crude ore.

"The development of selective flotation, due to its bearing on smelter operations, has caused the greatest change in lead smelting during the last few years. It has meant a smaller number of blast furnaces to handle the same or even a greater tonnage of lead. It has increased the problem of preparation of the blast-furnace charge, due to the fine condition of the concentrates. The lead metallurgist is meeting this obstacle by partly or entirely double roasting on the Dwight-Lloyd machines. In complete double roasting the intial charge, containing a large percentage of flotation concentrates and slimes, is given a fast preliminary roast that incompletely agglomerates the finer material and gives a product running around 9 per cent sulphur. This product is crushed to a suitable size for the 'second over,' where some granulated slag and sulphide are added to produce ignition. This produces a hard, firm, low-sulphur sinter.

"In partial double roasting, a portion of regular Dwight-Lloyd product is crushed to about 3 mesh and returned to the charge. This crushed sinter has a cellular structure and angular shape, which acts as an ideal binder in agglomerating the charge. Partial double roasting has also been recently taken advantage of in lowering matte-fall, where it has not been an absolute, although helpful, reason for agglomerating flotation concentrates. It has been customary for years to use the fines from oxide bed ores for diluent in sintering. Today, with the decreasing percentage of oxidized ores, the fine material, if left in the beds, is not a serious detriment. If, in place of these oxide fines, crushed sinter is used for diluent, the matte-fall can be largely reduced. The reason for this is due to the fact that it is more impractical to obtain a lower sulphur product when using oxide diluent than when using crushed sinter diluent. When we consider that the oxide diluent contains 1 per cent sulphur, or less, it is apparent that sinter with oxide diluent must be considerably lower in sulphur than sinter with crushed sinter diluent, to obtain the same sulphur elimination per unit of sulphide ore. In other words, if we make a 3 per cent sulphur product in each case, the oxide diluent in the one has had 2 per cent sulphur added. The increased cost due to crushing and returning this sinter is more than offset by the saving made in rehandling the decreased amount of matte produced. Improvement of the physical condition of the charge by using crushed sinter as diluent compensates for the increased amount of fines in the oxide beds at the blast furnaces.

"The handling of flotation slimes and returned sinter to Dwight-Lloyd machines has necessarily meant improvements and new machinery for handling. Devices such as squirrel-cage disintegrators and swing-hammer crushers have been necessary to break up and thoroughly mix the recalcitrant flotation product. Swing-hammer crushers and toothed rolls have been installed for crushing returned sinter at the plant."

Recent Technical Publications

Reviews, Abstracts, and References

Utilization of Arc Welding

"Arc Welding, The New Age in Iron and Steel." The Lincoln Electric Co., Cleveland, Ohio. 160 pages. Price $1.50.

This book is devoted largely to the use of arc welding in general production manufacturing. Arc welding is not to be looked upon merely as a repairing or salvaging process. The book attempts to demonstrate that a knowledge of arc-welding principles must be a part of the equipment of designers and manufacturers working in iron and steel. It contains more than two hundred illustrations, chiefly of products made by arc welding, together with diagrams and charts showing welding speeds and costs.

Two main fields for production welding are pointed out. The first is its use in place of riveting. It is demonstrated that a welded joint can be 100 per cent efficient, whereas the strength of a single riveted joint can never equal the strength of the members joined. Many products formerly riveted but now arc welded are described.

The second main field for arc welding is the substitution of arc-welded steel for cast iron. The book asserts that 90 per cent of the iron castings now used could be replaced by arc-welded steel at a decided saving. How to go about redesigning cast iron for manufacture in steel is discussed. The fundamental reason of the economy of arc-welded steel over cast iron is said to be that steel is six times as strong as cast iron in tension and 2½ times as stiff, but costs only one-third as much. Examples of complicated machinery bases and other cast-iron parts are shown reproduced in welded steel and in many instances cost figures are given. The procedure for redesigning machine parts is treated at length, and complete data on the strength and cost of various types of welded construction are provided.

Leaching at Sacramento Hill—"Heap Leaching Sacramento Hill Low-Grade Ore" is the title of a 2-page article in *The Mining Congress Journal* for October (Washington, D. C.; price 30c.), by A. W. Hudson. The low-grade copper ore taken from Sacramento Hill contains from 0.7 to 0.9 per cent copper, and it is planned to leach it for six years for a total recovery of about 70 per cent. Leaching operations have been going on for over two years now. The dissolved copper is precipitated with scrap iron.

Arizona Ore Deposits—U. S. Geological Survey Bulletin 782, pp. 192, by Waldemar Lindgren, describes the "Ore Deposits of the Jerome and Bradshaw Mountains Quadrangles, Arizona." The area described lies in the vicinity of Prescott and Jerome. Copies are obtainable for 50c. each from the Superintendent of Documents, Washington, D. C.

Quarry Accidents—The annual report on "Quarry Accidents in the United States," for 1924, by William A. Adams, has recently been issued as Bulletin No. 263 by the U. S. Bureau of Mines. The fatality rate was the lowest since compilation began, in 1911, but the non-fatal injury rate was somewhat above normal. The industry employed 94,242 men, who worked 25,327,858 man-shifts. Copies of this 76-page bulletin may be obtained for 15c. each from the Superintendent of Documents, Washington, D. C.

Standard Shovels—Among the bulletins giving suggestions for simplified practice among manufacturers, issued by the U. S. Department of Commerce, is one on "Shovels, Spades, and Scoops." Full dimensions are given, and also a list of manufacturers, associations, distributers, and consumers that have accepted the recommendations. The paper may be obtained from the Superintendent of Documents, Washington, D. C., for 5c. upon request for Simplified Practice Recommendation No. 48.

Ontario Mining—Part 1 of the 34th annual report of the Ontario Department of Mines, for 1925, pp. 196, obtainable on request from the department at Toronto, Ont., contains the following sections: Statistical review, 1924, by W. R. Rogers and A. C. Young; Mining accidents in 1924 and a descriptive list of mines in the province, by T. F. Sutherland and staff; a chapter on classes for prospectors, by W. L. Goodwin; and a chapter on power and transportation, by A. A. Cole.

South African Mining—The mining and metallurgical practice of the Messina (Transvaal) Development Co., Ltd., is discussed briefly in a three-page article in the Sept. 25 issue of *The South African Mining and Engineering Journal* (Johannesburg, Transvaal; price 6d.). Copper ore at this property is mined either by overhand stoping or shrinkage stoping, crushed by jaw crushers and rolls, ground in rod mills, concentrated by jigs, tables, and flotation, and the concentrate smelted and refined in a reverberatory furnace and a converter.

Gas Densities—No. 529 of the Scientific Papers of the U. S. Bureau of Standards is "A Review of the Literature Relating to the Normal Densities of Gases," pp. 36, by Marion Smith Blanchard and S. F. Pickering. An attempt is made to choose the most reliable value for each of thirty different gases. Copies of the bulletin may be obtained from the Superintendent of Documents, Washington, D. C., for 15c. each.

North Carolina—The industrial progress of North Carolina is described in an 80-page bulletin recently issued for free distribution by the Department of Conservation and Development, Raleigh, N. C. A highway map of the state is appended.

Connecticut Geology—The State Geological and Natural History Survey, Hartford, Conn., has recently issued Bulletin No. 33 on "The Geology of the Stonington Region, Connecticut," by Laura Hatch Martin, pp. 78, price 60c.

Smithsonian Report—The annual report of the Smithsonian Institution for 1925 contains, as usual, an appendix with many papers of general appeal to engineers and scientists. Among those of possible interest to mining engineers are: "Chemical Elements and Atoms," pp. 22, by G. Urbain; "The Manufacture of Radium," pp. 14, by Camille Matignon; "The Chemistry of Solids," pp. 9, by C. H. Desch; "Some Causes of Volcanic Activity," pp. 15, by A. L. Day; "Geology in the Service of Man," pp. 27, by W. W. Watts; and an appreciation of Sir Archibald Geikie, pp. 8, by Sir Aubrey Strahan. Copies of the report, which is cloth bound, may be obtained from the Superintendent of Documents, Washington, D. C., for $1.50.

Soviet Mining Concessions—The Far Eastern Concession Committee, Habarovsk, has published a book of 192 pages, with numerous charts and maps, entitled "Mining Concessions; After the Records of the Far Eastern Mining Board." The first section of the book discusses mining regulations and taxes, following which are descriptions of sixteen different auriferous districts and gold-ore deposits. In Part 3, seven deposits of coal, tin, molybdenum, silver-lead-zinc ore, iron ore, and tungsten are described. The work has been translated into English for the benefit of those interested in securing concessions to develop the mines of that part of the world, or for those who are interested in the country for other reasons. Copies of this book can be obtained from Mezhdunarodnaya Kniga, Kuznetski Most, 12, Moscow, Russia, for 4 rubles, 50 kop., or $2.32.

Vernon County, Mo.—"The Geology of Vernon County" is the subject of a bulletin recently issued by the Missouri Bureau of Geology and Mines, Rolla, Mo., pp. 152, with supplementary maps. F. C. Greene and W. F. Pond are the authors. Asphaltic sandstone and coal are the only mineral deposits known to be of any economic importance in this county.

Petroleum Geology—U. S. Geological Survey Bulletin 786-A, pp. 37, obtainable on request, discusses "The Geology of the Ingomar Anticline, Treasure and Rosebud Counties, Montana." The author is K. C. Heald.

The Department of Conservation and Development of the State of Washington (no address given) has published an abstract of a report on the geology and resources of the Pasco and Prosser quadrangles, to accompany a geologic map of the area. The district is of interest to petroleum engineers.

Californian Mining—The April issue of the quarterly publication "Mining in California" contains detailed data on the mines in Shasta, San Benito, and Imperial counties. The July issue is devoted to Marin and Sonoma counties. Copies of either are obtainable for 25c. each from the California State Mining Bureau, Ferry Building, San Francisco.

People You Should Know About

Garratt Wilkin, manager of the Moscow Silver Mines Co., operating near Milford, Utah, visited Salt Lake City recently.

Sir Harry McGowan, chairman and managing director of Nobel Industries, Ltd., left Southhampton on Nov. 12 for South Africa.

L. D. Knight, Salt Lake City manager of the Ingersoll-Rand Co., has returned from a business trip to the Northwest.

George W. Lambourne, president and general manager of the Park Utah Consolidated Mines Co., spent the holidays in Los Angeles.

William Dunn, manager of the Spruce Consolidated Mines Co., at Spruce Mountain, Nev., was a visitor in Salt Lake City recently.

J. W. Morrison, consulting engineer, Haileybury, Ontario, has been engaged to make an examination of the Grozell Mining Co., Kirkland Lake.

Dr. Hans Merensky and **G. H. Beatty,** consulting engineers to the J. C. I. Co., Ltd. (Barnatos), returned to Johannesburg from England on Nov. 9.

John Munro, many years business manager to the J. C. I. Co., Ltd., returned to Johannesburg on Nov. 16, after an extended visit to England.

W. H. Eardley, assistant manager of the United States Smelting, Refining & Mining Co., has returned to Salt Lake City from a business trip to California.

F. A. Unger, assistant consulting mining engineer on the technical staff of the Anglo-American Corporation, left Johannesburg for Salisbury on Nov. 7.

W. J. Kent, mine manager for the Maritime Coal & Railway Co., Amherst, Nova Scotia, has been appointed superintendent with headquarters at Joggins, Nova Scotia.

Campbell M. Brown, superintendent of the welfare department of the Utah Copper Co., has returned to Salt Lake City from the national tax convention held at Philadelphia.

G. W. Metcalfe, general manager of the Fairbanks Exploration Co., left Fairbanks, Alaska, recently, en route to the Boston offices of the U. S. Smelting, Refining & Mining Co.

Umfreville Percy Swinburne, Chief Inspector of Mines, Johannesburg, has been gazetted as Acting Government Mining Engineer, with effect from Nov. 1, vice **Sir Robert N. Kotze, retired.**

F. Gordon Osler, a director of the Consolidated Mining & Smelting Co. of Canada, Ltd., has returned to the East following a visit to the Sullivan mine and plants of the company at Trail, B. C.

Sir Ernest Oppenheimer, chairman, and **Carl Davis,** consulting engineer, to the Anglo-American Corporation of South Africa, Ltd., left Southampton on Nov. 12 on their return to Johannesburg.

J. C. Pickering, mining engineer, of New York, has been appointed manager of Patiño Mines & Enterprises Consolidated, at Llallagua, Bolivia, South America, and recently assumed his new duties.

Felix E. Wormser, manager of the Canadian Mines Merger, Ltd., of Kaslo, B. C., and formerly on the editorial staff of *E. & M. J.*, returned to New York with his family last week, to remain for two or three months.

Fred W. Callaway, mining engineer, of Kellogg, Idaho, is spending the Christmas holiday at his former home in Minneapolis. He will visit other cities in the Middle West and possibly in the East before returning home.

W. R. Brock, dean of the faculty of science at the University of British Columbia, has been appointed to represent the Dominion of Canada at the third general assembly of the Union of Geologists and Geophysicists which is to be held at Prague in 1927.

Gordon R. Campbell and **Edward Collins,** president and vice-president respectively of the Calumet & Arizona Mining Co., recently visited Jerome, Ariz., to inspect the workings of the Verde Central Mines Co., a subsidiary of the former company.

H. A. Barker, mining engineer and metallurgist, has resigned his position as administrator of the National Lead Co.'s mines at Pumahuasi, Argentina, and has joined the firm of Rolfe-Rogers & Berzon, Talcahuano, 74 Buenos Aires, Argentina, South America.

The Hon. William Sloan, Minister of Mines and Provincial Secretary for British Columbia, who has been ill for several weeks, left Victoria on the motor ship "Aorangi" on Dec. 15 for Honolulu, to regain his health. He expects to be away for about six weeks.

David H. K. Bottrill, an Australian metallurgist who is engaged in research work at McGill University, Montreal, is perfecting a process for welding breaks in aluminum transmission cables by the use of thermit which he claims will prove simple and economical.

Walter L. Haehnlen, president of the Tonopah Mining Co., of Nevada, has returned from a visit to the Tonopah Canadian mine, in the Gowganda area of northern Ontario, operated by a subsidiary company. He expresses himself as highly pleased with the progress made in the development of the property.

State Mining Engineer Montgomery of Western Australia is retiring from that position. The Mines Department of the state is being reorganized, and applications are being invited, both locally and abroad, for the post of State Mining Engineer, who will have control of the administration of the department.

H. J. Hawley, of the geological department of Standard Oil Co. of California, has been elected chairman of the Pacific Coast Section of the American Association of Petroleum Geologists. **M. L. Taliaferro,** professor of geology at the University of California, has succeeded **Carol M. Wagner,** as secretary-treasurer.

S. P. Tinney, a metallurgist on the staff of the Bureau of Mines, will make further studies of blast furnace conditions under an arrangement with the Illinois Steel Co. These special investigations, which will be conducted at South Chicago, have as their objective a more definite knowledge of what takes place in the blast furnace.

William Buchanan Gray, technical director for Lever Brothers in South Africa, who had been in this subcontinent since 1911, previous to which he was in Sydney, New South Wales, for the same firm, left Johannesburg on Nov. 12 for Durban, en route to England, where he is to be assistant works manager at the Port Sunlight works.

Latham Watson, petroleum specialist, has been appointed by the Australian Federal Government to supervise applications for assistance under an oil-prospecting statute passed last year. Mr. Watson, before going to Australia, had extensive experience in Rumania and Trinidad. His first important work in his new position was to make a careful investigation of the Roma district, in Queensland, which has been pronounced by Dr. Arthur Wade to offer the most promising oil possibilities of any areas in Australia.

Obituary

Thomas I. Norton, who died at Elsburg, East Rand, on Nov. 17, aged sixty-four, was one of the old pioneers. He left Aliwal North in August, 1886, with five others, coming to the Rand in a small ox wagon. The journey occupied over a month. He was present when Booyseno and Doornfontein farms were proclaimed as diggings, and took an active part in mining and farming developments on the Reef.

James Furman Kemp

In Memoriam

He lit warm fires in the cold rooms of life; he made life richer and lovelier to the many that now mourn his loss, in grateful remembrance of his friendship. The career of James Kemp was linked chiefly with his work as a teacher at Columbia University, where he demonstrated the fact that in a democratic country, striving to develop civilization under liberal conditions, the teacher, the professor, the leader of youth, is a factor, even now, inadequately appreciated by the community. He was so much more than a professor of geology to the successive classes that passed out of the University; he was a guide, philosopher, and friend to the young men who went forth from Morningside into the world, and called him blessed. At his last public appearance, a meeting of the local section of the American Institute of Mining Engineers in New York, he was introduced as "Uncle Jimmie"; and, in beginning one of his characteristically urbane and interesting discourses, he said that it pleased him to be thus greeted, adding with a smile that not even the brother of Brigham Young had so many or so fine a lot of nephews as he had. That sobriquet of "Uncle Jimmie," by its affectionate implications, bespoke the human kindliness of his relations to the young men of the mining profession. To us, his contemporaries, he was "Jim," a

brother, a dear comrade, a co-worker always ready to help in the serious work of the world, a fellow scientist of the highest intellectual honesty. One of his former students, now a distinguished professor himself, spoke of the genuineness of the man and of his complete lack of pretense: how, when speaking to his class on the subject of dynamic geology, he disclaimed any special knowledge of mathematics. "They loved him for it—and for much else."

When a young professor of geology at Cornell he wrote a paper on the Camptonite dikes that attracted attention on account of its true scientific spirit in not accepting current theory without thoughtful inquiry. In this early contribution to geology he exhibited a mind already trained to sound habits of investigation. In after years he contributed voluminously to scientific publications in many countries, and always helpfully. Kemp had the invaluable faculty of simplifying his subject; this made him a popular teacher, not in the sense of aiding an appeal to the light-minded, but of making himself readily understood, and interesting, to his hearers, and to those that used his writings as textbooks, notably, "The Constitution of Rocks" and "Ore Deposits." The latter especially was used widely in the mining schools; it was the first comprehensive description of ore deposits in the United States, and was appreciated by mining engineers in the field as an invaluable compendium, aiding them, by the study of types, in diagnosing the character of the deposits they had to appraise or develop. Here again the recognition of his scientific ability is touched by a recollection of his charming personality; his *bonhomie* made memorable the recurrent celebration of the graduate students in geology known as the "Brothers of the Rocks," who at their annual dinner were steered repeatedly into humorous performances by their beloved professor. One year the menu and the speeches were in Latin or pseudo-Latin; another time they were couched in Spanish or pseudo-Spanish—and it was the "pseudo" that made the fun. When a Chinese student, C. Y. Wang, graduated, he invited his petrographic brethren to dine with him; and on that occasion the Professor, to the amused astonishment of the company, delivered a speech in Chinese, bewildering even to Mr. Wang until he recognized that the speaker had strung together the Mongol names taken from a geographic map! His droll extravaganza, "The Geology of Jell," was published in the *Mining and Scientific Press*, and added to the gaiety of nations, even the King of Sweden sharing the amusement. He was full of quips and cranks, as his correspondents know, for in the epistolary amenities likewise he was charming. He wrote long letters in his own hand, in the old-fashioned way, giving real news about himself and other friends, and commenting wisely or whimsically, as the subject demanded, on the topics of the day.

Besides his work as a teacher of science he was a pioneer of research in sundry phases of economic geology, among which mention may be made of contact metamorphism in relation to the occurrence of copper ores. Another subject that he elucidated especially was the limited scope of the ground-water in veins; he was one of the first to point out the decreasing wetness of deepening mines, most of which become dusty on the bottom levels, and he explained the significance of this fact in connection with the mineralizing activities of underground solutions. In company with other distinguished geologists he took part in mining litigation in the

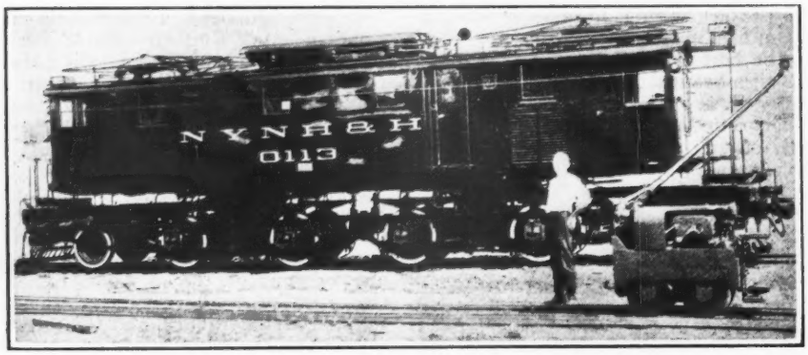
Mr. and Mrs. Kemp at La Rabida, Spain, May 18, 1926

capacity of an expert witness, a performance that makes a severe demand upon intellectual honesty. It is characteristic of him that he was able to give his evidence truthfully, as a scientist, without yielding to the weakness of partisanship, and that in the course of his appearance in various lawsuits, of unusual importance, he won not only the affectionate regard of his own side in these legal controversies, but also the respect of his opponents and the confidence of the Court itself. One of the lawyers frequently opposed to him remarked to me a few days ago: "He was a perfect gentleman." It is a pleasure to restore a much abused word, "defamed by every character and soiled by all ignoble use," to its proper significance by identifying it with James Furman Kemp. The same lawyer testified that our friend was scrupulously fair; he avoided exaggeration or the placing of undue emphasis on geologic evidence that he knew to be doubtful, and therefore controversial.

He was a delegate to the International Geological Congress at Madrid in May last, and was unanimously chosen by his colleagues from the United States as their national representative. At the sessions in Madrid, and on the excursions to various mining districts, he took a prominent part, highly pleasing to everybody, by reason of his courtesy and good sense. At sundry official dinners and similar functions he was called upon to express our thanks for the entertainment provided by our Spanish—and English—hosts; he did this, of course, *suo more*, delightfully. Of such incidents those of us in attendance at the Congress will remember best the speech he made on the occasion of the laying of a wreath at the foot of the monument to Columbus at the monastery of La Rabida, near Huelva. That picture will remain in our memories indelibly. Dignified in pose, quiet in manner, the Professor, on the spur of the moment, reviewed the work of the great navigator, his sojourn at La Rabida, and the pathetic close of his checkered career, not omitting a reference to the fact that the speaker represented an American university that is named after the discoverer of the New World. At the close of the speech Mrs. Kemp handed the wreath of flowers to her husband, and he placed it on the pediment, to the accompanying applause of the assembled company. The association of husband and wife in this graceful act is a reminder to us now, as it was then, of the comradeship between them, and of the devoted care that only a few years earlier had enabled him to recover from an illness that at one time threatened to end his usefulness.

He was ill more than once during his last European tour, but these disabilities were of short duration; he was quick to resume his wonted urbanity and cheerfulness. After the congress at Madrid he and Mrs. Kemp went to visit their married daughter, then temporarily at Berlin; it is symptomatic of his own intrepidity and of his wife's comradeship that they traveled from Berlin to London by airplane, arriving there in the best of spirits and exhilarated by the novel experience. He returned to his work at Columbia with great zest and resumed the multifarious duties that he performed habitually with such complete sincerity of purpose. To his willingness to help everybody, either of the faculty or of the student body, he owed the breakdown in health that eleven years ago compelled him to retire from active work for four years. He was only too willing to spend himself, his thought and his energy, in behalf of others; a veritable uncle, he stood in sagacious and helpful relationship to so many that a physical collapse was by no means surprising. This untoward event is worthy of mention because when on the road to recovery he had the courage to exile himself at Tulsa and there engage in deciphering the geology of the mid-continental oil fields; and the event is also memorable because it was the means of presenting to his friends and acquaintances an example of wifely devotion which was the chief factor in his convalescence and a means of prolonging his beneficent usefulness for another decade. Today, when bereavement has laid its heavy hand on the patient shoulders of the dear lady, it must be an assuagement of grief to remember how she stood by her hero in the day of his stress. T. A. R.

New Machinery and Invention



Mine locomotive of type and size as used at Park Utah mine compared with an electric railway locomotive

A Small Trolley Locomotive

One of the smallest trolley-type locomotives in use in this country is used by the Park Utah Consolidated Mines, of Keetley, Utah. This was built by the General Electric Co. and is designed for 18-in. gage track. It has a total weight of 3,296 lb. The couplings, steps, and trolley are removable, in order that the locomotive may be taken down small mine cages. It is equipped with coupler sockets, so that it may be used in tandem with others of the same type. The rated drawbar pull is said to be 400 lb.

The locomotive is operated on two trolley wires and rails are not bonded, as the track is very hard to maintain. These locomotives operate in sections where it is impossible to use mules on account of the lack of water.

A New Non-Clogging Pump

A non-clogging centrifugal pump has just been placed on the market by the American Well Works, of Aurora, Ill. The design of this pump marks a new departure in construction and obviates the necessity of screens and their expensive maintenance.

The single blade impeller in the pump is so designed that the stream lines are not separated, but instead the stream of fluid is kept in one mass and carried through the pump without being subdivided. By compelling all the liquid and débris to be discharged through a single peripheral passage, the possibility is avoided of different portions of a single piece of débris being swept into different outlet passages and thereby being hung up within the impeller.

This pump is made in both vertical and horizontal types and is adapted for municipal sewage and general industrial use. Engineering information may be obtained from the engineering department of the company.

Low-Pressure Air in Flotation

Air at unusually low pressures is to be used by the Nevada Consolidated Copper Co. for flotation purposes. Two sets of motor-driven centrifugal compressors will furnish it. The compressors will be of General Electric manufacture and each will consist of a 1,250-hp. synchronous motor driving a centrifugal blower rated at 60,000 cu.ft. per minute at 3.4 lb. equivalent sea level rating. At the altitude of the plant air will be delivered at 2½-lb. pressure.

These will probably be the largest-capacity machines ever made for this pressure, the usual pressure used for this work being about 5 lb. The machines will run at 3,600 r.p.m., the motors being direct-connected and built into the blower, forming a complete, self-contained unit. The blowers will be of the single-stage type, occupying little floor space, each unit requiring a space of only 11½ ft. by 9 ft. 7 in.

Heavy-Duty Belt Clamp

Clamps of a new design for joining fabric base belts in heavy-duty service have been announced by the Victor Balata & Textile Belting Co., 38 Murray St., New York. These are known as the Petrol belt clamp and were originally developed to increase the life and service of oil-well drilling and pumping belts which operate under extremely severe service. These clamps are also used for exceptionally severe industrial service.

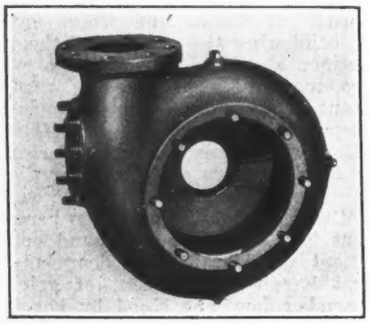
The type of clamp and its application are shown in the accompanying illustration. The clamps are made of steel forgings and are bolted together with carriage-style bolts, hexagon nuts, and lock washers. The clamp and fittings are galvanized. Corrugations on the jaws of the clamp give a better grip on the belt, it is said, and so help to prevent tearing. Also, the clamps are curved at the angle. This, according to the manufacturer, prevents the clamp from cutting the belt and also avoids misapplication.

The jaws of this belt clamp are corrugated

Catalogs

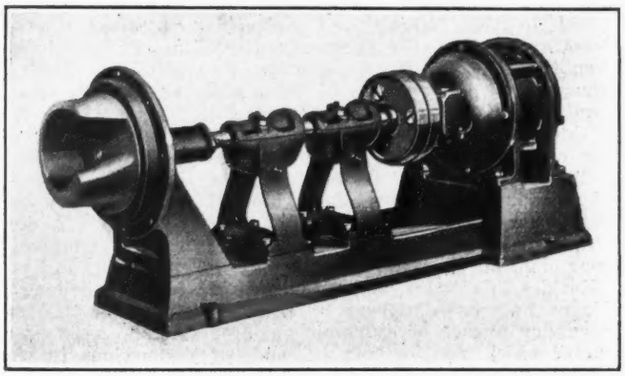
The Amtorg Trading Corporation recently has published a handsome, leather-bound "Catalog of American Industry and Trade." The volume consists of 1,036 pages, 9 by 12 in., and is extensively illustrated. It is printed entirely in the Russian language and is designed as a directory and guide for Russian firms requiring industrial machinery and sundry other related products. About 400 of the leading American companies are represented in the book, among them many makers of mining machinery and equipment. Much engineering information is given.

Diamonds—Anton Smit & Co., of Antwerp, importers of industrial diamonds, has issued a pamphlet entitled "Diamonds for Industrial Purposes." The company's agent for the United States, Canada, and Mexico is the Selma Mercantile Corporation, 15 Moore St., New York.



Left — Casing of non-clogging centrifugal pump.

Right—Motor that drives non-clogging pump and single blade runner.



Market and Financial News

Silver Decline Hits Fresnillo Operations of Mexican Corp.

AT THE MEETING of the Mexican Corporation in London recently, F. W. Baker, the chairman, commented on the effect of the decline of silver on the profits of the company's operations at Fresnillo, Mexico. The company mines ore averaging about 5.25 oz. silver and very little gold. It probably holds first rank among silver mines for the low grade of its ore. Mr. Baker's remarks follow:

"When I addressed you in December last year silver was standing at over 70c. At this price, on the basis of treating 3,500 tons of ore per day from our surface orebodies, we were making at the rate of £105,000 per annum from the treatment of oxide silver ores alone. From that time, with declining silver values, profits rapidly fell away, and with silver at its present price, treating the same grade of ore and at the same daily tonnage, we can only work these surface orebodies at a comparatively small profit."

Patino Mines & Enterprises shares to the amount of $5,000,000 have been underwritten by Lehman Brothers. The shares, totaling 200,000 out of 1,400,000 outstanding, were offered at a pre-listing price of $25 and are now apparently active on the New York Curb at $25⅜. The principal asset of the company is the group of tin mines in Bolivia that originally were owned personally by Senor Simon I. Patino, press-agented as one of the richest men in the world. The following table shows approximate earnings in recent years:

	Production, Gross Tons	Earnings
Nine months ended Dec. 31, 1924....	10,284	$5,309,277
Year ended Dec. 31, 1925	10,039	7,016,222
Ten months ended Oct. 31, 1926.....	8,733	5,271,885

Messrs. Yeatman and Berry, consulting engineers, estimated "postive and probable" ore early in 1926 at 1,061,000 tons before sorting, having a total tin content of 50,289 tons. The company earned a good surplus over and above dividend requirements in 1925. The announcement of the broker offering the shares makes no mention of the source of their block of shares, but presumably they were the personal property Patino.

Tintic Standard has declared regular dividend of 20c., payable Dec. 23 to stock of record Dec. 11, and an extra of 30c, payable Jan. 3 to stock of record Dec. 11. In September the extra dividend was only 20c., the additional 10c. apparently being a Christmas present.

A. J. M. Sharpe "Not at All Pessimistic" on Zinc

French Situation Bad; but British Outlook Better—Safety Valve in Working Order

Early December is rarely an auspicious time to review the zinc markets, inasmuch as the imminence of Christmas and the holidays is incidental to a period of quietness, says A. J. M. Sharpe, honorary foreign corrrespondent of the American Zinc Institute, in his monthly review. Consumers naturally desire to keep their stocks as low as possible during the stocktaking time, and there is no less a decided tendency on the part of traders to restrict commitments.

With the turn of the year we may hope for better things. The British coal strike has fizzled out, and industries in the United Kingdom are preparing for a busier time than was experienced in the year just closing. Consequently, it may be safely assumed that from January there will be a fair increase in the British consumption of zinc, although in a month or two such enhancement will be met by domestic production. Since the suspension of British zinc smelting soon after the start of the coal strike on May 1, last, every ton of zinc consumed has necessarily had to be imported. With comparatively cheap domestic coal once again available, the various smelters are preparing to resume operations, and though it will be some weeks before they get into full swing, we can at least expect some output in January.

British consumers are lightly stocked with metal, and, if they do not buy immediately before Christmas, they must inevitably enter the market for supplies early in the new year.

The more encouraging outlook so far as England is concerned is unfortunately counteracted by the quieter condition of trade on the Continent. So far as zinc is concerned, the fabricating trades in Europe are experiencing the slacker times peculiar to the winter, the rollers and oxide makers being the chief sufferers. Then we see today a decided slump in industry in France. That country has not known the unemployment problem since the war, as it has benefited from the transitory advantages of inflation. But in the past few weeks the franc has appreciated so rapidly as to leave the cost of living behind, and manufacturers have been unable to readjust conditions in the shape of wages and supplies. Thus it is that French industry as a whole is beginning to taste the aftermath of inflation, and is faced with the same real difficulties that have beset the other nations in their respective periods of deflation.

In the case of zinc, France finds itself unable to import Belgian zinc as hitherto, and the tonnage in question is consequently being offered in England, to the embarrassment of the London market. Though in January it may be possible for Great Britain to absorb this extra quantity, its pressure on the market just now is naturally a depressing influence.

Even in Germany, where there has been steady progress in the metal and other industries for many months, something of a seasonal let-up is noted, and traders evince no desire to carry stocks of the non-ferrous metals.

Today, more than at any time since the war, the London Metal Exchange is regarded by all nations as the key to the base-metal situation, and London quotations govern world market prices.

The safety valve in the case of zinc lies in the fact that there is comparatively little profit in the current selling price vis-à-vis cost of production. It, therefore, goes without saying that, if the price drops below the economic level, the higher-cost producers will promptly cease outputting and provide the necessary market brake.

The outlook for 1927 can more aptly be covered in January, says Mr. Sharpe, who adds: "I will content myself today by stating that I am not at all pessimistic as to the prospects for the zinc industry over next year."

His estimate of stocks of slab zinc on Dec. 1, 1926, is as follows:

	Metric Tons
United States	13,200
Canada	2,300
Australia (including unsold shipments afloat).....	2,300
Germany-Poland	7,500
Belgium	3,200
France	1,400
Great Britain	1,000
Scandinavia	200
Far East.....	500
Elsewhere	1,500
Total	33,100

Consolidated Mining & Smelting Co. of Canada has declared a dividend of 5 per cent and a bonus dividend of $5 per share, amounting to $3,168,825, covering operations for the second half of 1926. This brings the disbursement for the year up to $5,070,120 and the total disbursement to date up to $16,405,975. Large as these dividends and bonuses are, they amount to less than half of the company's net earnings for the year. Official estimates of net earnings for the first half of this year are $6,315,831. The metal output for the second half of the year has been appreciably larger than that of the first half; so, despite lower metal prices, it seems safe to predict that the earnings have been $14,000,000. Total outstanding capitalization is $14,979,720, and earnings for 1926 will therefore be nearly 100 per cent on the par or nominal-value amount of the outstanding capitalization.

Consolidated Gold Fields Expands American Activities

British Corporation Derives Principal Profit from Rand Gold Mines—Has Extensive American Interests

Profits of the New Consolidated Gold Fields, Ltd., operating subsidiary of the Consolidated Gold Fields of South Africa, amounted to £438,715 for the fiscal year ended June 30. The largest source of profit was the dividends received from the company's holdings in Sub-Nigel and Robinson Deep. The announced policy of the company is to hold the shares in these two companies as revenue producers, for the time being at least, rather than to realize on the phenomenal advance in the market value. Reports state that Sub-Nigel continues to open up rich ore, and, provided sufficiency of native labor can be had, 16,000 tons should be milled in December. Profits are expected to increase monthly from now on, and the full benefits from increased plant should show from March onward.

Simmer and Jack Short of Labor

Development on Robinson Deep continues to open up good ore at depth, and a material increase in profits is expected after installation of a sorting plant and a new hoist. The former should be complete by the end of June and the latter by the end of 1927. It is estimated that the cost of this will be £51,000, but the additional profit to be made therefrom is expected to recoup this expenditure within twelve months. There will be no interruption in milling operations while the necessary alterations are being carried out. The Simmer and Jack Mines had suffered more than other mines from shortage of native labor, which had delayed the de-watering and re-equipment of the area upon which the future prosperity of the company depended.

The suspension of operations by the Comstock Merger Mines Co., operating in Nevada, is forecast in the report. Although operation of the properties from October, 1924, to the end of 1925 showed a profit, the grade of ore sent to the mill was considerably lower than estimates based on sampling the old fill. "The recent severe fall in the price of silver," says the report, "has made the profitable continuation of operations a matter of doubt, though average working costs since the commencement of operations have been as low as $3.838 per ton, including $0.362 for prospecting and development." The discontinuance of work has been announced for Dec. 15, the action being taken subsequently to the writing of the report of the holding company.

The other American interests of the company are summarized in the following manner:

In June, 1926, the assets of American Trona Corporation were transferred to a new corporation called American Potash & Chemical Corporation in accordance with the terms of a reorganization scheme referred to below.

During 1925 the plant produced 53,755 tons of high-grade potash and borax salts, being 5,792 tons more than the 1924 production. The operating cost per ton produced in 1925 was 10.5 per cent lower than the 1924 cost. The operating profit for 1925 amounted to $406,994 before deduction of depreciation and interest charges.

American Trona Profitable

In the report covering the operations of American Trona Corporation for the year 1924 it was stated that the progress recently made in methods of operation resulting from continuous experimental work had not yet been fully reflected in the financial results obtained, and that it was anticipated that the corporation was then in a position to make an operating profit at the rate of about $500,000 per annum. This estimate has proved to be correct, inasmuch as from July 1, 1925, to June 30, 1926, an average operating profit of $46,247.15 per month has been made, or a total operating profit of $554,965.80 for that annual period. During this period average operating costs were as much as 18 per cent below those of 1924.

Owing to these encouraging results it was decided by the board of the Trona Corporation to enlarge substantially the plant at Searles Lake, and arrangements were made in 1925 for the provision of the necessary capital to carry out this work. An enlargement of the plant at the same time provides the opportunity to install new and up-to-date machinery in connection with certain parts of the manufacturing operations. In view of the fact that the corporation's engineers estimate that the enlarged and improved plant will turn out more than twice the amount of potash and borax as is now being produced, at a cost per ton much below that which is now being obtained, the expenditure involved in the enlargement is well justified.

New Equipment at Searles Lake

The installation of the new equipment at the plant is now approaching completion and the enlarged output is expected to commence at an early date. Even taking into consideration the probability of lower borax prices as the result of the competition in the borax market which will be engendered by the increased production of the corporation's plant, it appears reasonably certain that the corporation from the beginning of 1927 onward will be capable of earning substantial profits after deduction of depreciation and interest charges.

During the year ending Dec. 31, 1925, South American Gold and Platinum Co. and its subsidiaries recovered 12,233.056 oz. crude platinum, and 5,140.07 oz. gold, having an estimated value of $1,263,000. The recovery of platinum and gold during 1925 was substantially less than during the preceding year on account of the fact that in the case of Dredge No. 3 time was lost while the necessary changes were being made to admit of its being driven by electric power, and, in the case of Dredge No. 1, owing to litigation in connection with a property on which the dredge was operating. Apart from these unavoidable shutdowns, operations were in all respects satisfactory.

Dredge No. 3 was closed down for conversion from steam to electric power on Dec. 17, 1924, and resumed operations after completion of the work on March 8, 1925. Dredge No. 1 was idle for all but two months of the year on account of a legal dispute in connection with the Castillo Concession, a concession held from the Colombian Government by the Anglo-Colombian Development Co., a subsidiary of South American Gold and Platinum Co.

The recoveries up to the end of Sept., 1926, amount to 14,310 oz. crude platinum and 4,055 oz. gold. The high rate of production obtained since the beginning of April should be maintained during the remaining months of the year, and it is therefore to be expected that the total production during 1926 will be considerably greater than in any previous year of the company's history.

Dredges Electrified

During 1926 the profits earned by the company have been greatly increased by reduction in working costs owing to the fact that the two larger dredges have been supplied with cheap electric power from the company's hydro-electric plant, and owing to steady operation of the dredges. During 1926 operating costs for a full monthly period, including New York office expenses, have been as low as 8.6c. per cubic yard in the case of Dredge No. 3, and 14c. in the case of Dredge No. 2.

A steady drilling campaign has been carried on with as many as ten drilling outfits in order to increase the ore reserves of the company by proving up additional areas of gravel which are known to contain values. Results have been obtained to date from this drilling which already indicate a considerable increase in the value of the company's properties and the area available for future dredging.

The company and its subsidiaries have on hand at the present date cash, United States Government securities, platinum, and gold amounting to $1,300,735. The company is now earning large profits from its operations and with every reason to expect a continuation of normal operating conditions at the company's properties it is to be anticipated that the directors will be in a position to declare a dividend in the near future.

An investigation was made during the early months of 1926 of the possibilities offered by mining operations in the zinc district near Joplin, Mo., usually known as the Tri-State zinc district. The ore deposits of this district, which consist of gently dipping strata containing zinc ores at depths varying from 50 to 400 ft., can be tested by shallow drilling operations. As a result of a comprehensive survey of the district it was decided that there existed favorable opportunities for the

development of profitable orebodies at a cost for exploration and development considered to be low in comparison to the possibilities offered by the proving of any considerable tonnage of ore. An arrangement was subsequently entered into with a firm of local engineers and geologists, who have been successful in the past in the same connection with other large mining companies, by which properties should be acquired under option and tested by the drill under the supervision of the engineers of the Gold Fields American Development Co., Ltd. These operations are being carried out by two companies known as the Missouri Mining Co. and the Tri-State Zinc, Inc., which, to conform with the state laws of Missouri and Kansas, were formed for that purpose. These companies have now twenty-two drills in operation on the various leases which have been taken up.

The first group of properties which was taken up under option is known as the Blue Mound group. The drilling done to date on this group, amounting to twenty drill holes, has been satisfactory. The work is not sufficiently far advanced to make an estimate of tonnage of ore, but the existence of sufficient good-grade ore has been proved to justify the belief that a mine will be developed on the property. This group has upon it a dump of 1,250,000 tons of tailings, which has been purchased, together with a small tailing mill which is also on the property. This tailing mill has been enlarged and equipped at a small expense to handle approximately 1,000 tons of tailing a day, and results of milling to date have shown that substantial profits can be earned on the basis of present zinc prices.

On the Oronogo group, which is being drilled under an option to operate it on a royalty basis, the drilling carried out to date has given encouraging results, a majority of the holes drilled to date having shown ore of a satisfactory thickness and grade. The group is, however, in an area which will have to be unwatered at considerable expense before mining operations can start, and it will be necessary to prove a large tonnage of ore before such expenditure would be justified.

The Waco group, over which an option has been acquired recently on favorable terms, is believed to be promising both on account of the results obtained from workings of neighboring mines which come up to the side lines of the property, and also on account of results of considerable drilling and underground work which has already been done on the property.

Dredging operations of the Yuba Consolidated Gold Fields for the fiscal year ended Feb. 28, 1926, are as follows:

	Total	Per Cubic Yard
Returns	$2,752,254.48	0.0966
Expenses	1,279,527.55	0.0449
Operating profit	$1,472,726.93	0.0517

During the year six dredges were in full operation. The operating profit shows an increase of 99 per cent in comparison with the profits of the previous year.

The management points out that the results obtained are remarkable in view of the fact that the ground excavated exceeded by 2,470,085 cu.yd. the amount dredged during any previous year. This was due to the employment of dredges of the larger size, and to the easy conditions which at times prevailed, and it is considered doubtful if this record will again be equaled.

During the six months ended Aug. 31, 1926, the total returns were $1,284,183.21, expenses $571,215.93, and net returns $712,967.28.

Satisfactory progress has been made with the equipment of a mill on the property of the Botanamo Corporation, near Tumeremo, in Venezuelan Guiana. The mill machinery and other equipment amounting to 429 tons in weight has been shipped to the property under difficult conditions of transportation, and rapid progress is now being made with the erection of the mill, which is expected to be in operation before the end of 1926.

Statistical Notes

Copper Share Statistical Chart: 1926 Edition. This chart has recently been issued. It is a well-known compilation, originally made by E. N. Skinner, and has been revised by him. The data include financial and operating information on fifty-five leading American copper-mining companies and sundry metal statistics. Bankers, brokers, shareholders, mining engineers and operators, professors, economists and copper consumers should find the chart of value. The price is 75c. and the address of the publisher 120 Broadway, New York City.

St. Joseph Lead Co., through its trustees, has declared dividends on the outstanding stock for each of the four quarters of the year 1927. These amount to 50c. "regular" and 25c. "extra" for each quarter. The dates of payment are March 21, June 20, Sept. 20, and Dec. 20 to shareholders of record on the ninth day of the corresponding month.

Federal Mining & Smelting Co. during the quarter ended Oct. 31, 1926, realized net earnings of $1,064,342 before charges for construction and equipment, depletion, depreciation, and taxes. This compares with $937,951 in the preceding quarter. The low price received for lead was 7.95c., New York, and the high 8.95c. Shipments of ore and concentrate during the quarter totaled 49,388 tons, compared with 43,841 in the preceding quarter.

Bauxite production of the world for the year 1926 is estimated by R. J. Anderson to be 1,475,000 tons, a new high record for all time. France, with an estimated output of 440,000 tons, is the leading contributor. British and Dutch Guiana, Italy, and Jugo-Slavia increased their outputs substantially, whereas the production of the United States continued to decline.

American Metal Co. dividend rate is likely to be reduced from $4 to $3 on the 593,000 shares of common stock, according to forecasts in Wall Street. Net earnings for the first nine months of the year after providing for the preferred stock were $2,089,881—barely enough to cover the common dividend. Several factors have conspired to make the last half of 1926 a period of lean earnings. The slump in silver caused a recession. Likewise lead, zinc, and copper have all been declining. Also, the company has been prosecuting a broad expansion program. This has taken considerable cash, and the new units have not had time to return earnings.

Garfield Smelter of the American Smelting & Refining Co. produced 30,000,000 lb. of blister copper during November, thereby breaking all previous records for the plant. The fact that only 1,200 men are required, against 2,000 at the peak of war production, reflects both the greater efficiency of the individual worker and the advances in ore dressing and metallurgy, and the greater mechanicalization of operations. The overwhelming proportion of the copper comes from the mines of the Utah Copper Co. at Bingham. Utah, of course is a Kennecott subsidiary.

Newmont Mining Co. has declared a dividend of 5 per cent in stock and the regular quarterly dividend of 60c. in cash, both payable Jan. 17 to stock of record Dec. 31.

Tonopah Extension Mining Co. has authorized the issuance of $300,000 worth of three-year 10 per cent first-mortgage coupon bonds subject to the approval of the Arizona Corporation Commission. A deficit is expected to result from operations of the coming year, but the management feels that conditions in the mine are sufficiently good to warrant the expenditure of further money, and to this end the bond issue is being authorized. It would appear that the issue of preferred stock of last year made the common stock practically valueless, and the proposed bond issue would necessarily decrease the prospective value of the preferred stock.

Chile Copper Co. for the nine months ended Sept. 30 produced 163,937,353 lb. of copper, but sold only 154,758,757 lb. Calculating earnings on the basis of sales instead of production, the surplus for the nine months is less than that for the corresponding period of 1925 and the surplus for the third quarter likewise is lower. The comparative figures, after deducting all expenses and charges, including depreciation, amortized discount on 6 per cent convertible bonds, accrued federal taxes, and accrued bond interest to arrive at surplus, are as follows:

First nine months:	1926	1925
Total sales (lb.)	154,758,757	149,460,644
Gross receipts	$22,205,544	$21,729,665
Surplus	8,588,284	8,878,882
Quarter ended Sept. 30:		
Total sales (lb.)	46,675,530	55,200,026
Gross receipts	$6,783,228	$8,071,597
Surplus	2,427,427	3,276,235

Ontario metal production for the nine months ending Sept. 30 was valued at $44,339,619, a decrease of $1,300,000 compared with the corresponding record-breaking period of 1925. The lower average of metal prices, particularly of silver, contributed to the decline. Gold production increased in value, as did that of the copper-nickel.

The Market Report

Metal Prices Sag in Holiday Market

Silver Back to 54c. But Copper, Lead, Tin, and Zinc Are Softer—Volume of Sales Satisfactory

New York, Dec. 29, 1926—No one expected that much metal would be sold in the week ending today, so the volume of sales, though small, has been satisfactory. However, prices have not held as well as was anticipated, with the single exception of silver. Copper is off another eighth of a cent from a week ago; zinc is back to an even 7c.; lead is wobbling; and tin is down about a cent from last Wednesday's quotation. The stock market was very weak yesterday, which may have had a bad effect. General business conditions continue good and promise to remain so in the first part of the coming year, but the trend of the general commodity price index is distinctly downward at present.

Copper at 13⅜c. Delivered

A little copper was sold last Thursday, after which practically no business was done until yesterday and today, when several orders were booked, though the total tonnage was, of course, way below an average week. Yesterday's business was placed partly at 13⅜c. delivered Valley, and partly at 13½c. More was offered at the lower price than was taken, and this morning at least one offer at 13⅜c. was turned down by the potential buyer, though on other small business 13.40c. was done. Middle Western quotations have ruled about ½c. above these prices. Most of the copper has been for first quarter shipment. Some large producers are entirely out of the market at current levels. The foreign market has been quiet, though a fair amount of business has been done. Today the price was reduced from 13.95 to 13.85c., c.i.f. The f.a.s. price has varied from 13.55 to 13.70c.

Lead Quiet and Easier

The volume of lead buying has been fair, but a tendency is manifest to shade the official price of the American Smelting & Refining Co. in New York as well as that of the leading interest in the St. Louis market. The Smelting company's contract price remains at 7.80c., New York, and most of the business in the West has been done at 7.65c., St. Louis. A good tonnage for February delivery last Thursday and Friday was sold at 7.75c., N. Y., and today a little prompt metal may be available at that figure. Probably the outstanding fact in the lead situation is that net imports into the United States during 1926 will amount to about 75,000 tons. The corresponding figure for 1925 was 15,000 tons. This reveals the increased proportion of Mexican ore lead that has gone into consumption on this side of the ocean instead of in Europe. It emphasizes the remarkable ability of the domestic market to absorb the metal, but likewise explains in large measure the lower average price. Hope for better lead prices in 1927 apparently rests on greater activity abroad.

Zinc at 7c.

A moderate business has been done in zinc, for various dates of shipment, from prompt to March. Some sellers have been unable to get more than 7c. throughout the week, whereas others have sold as high as 7.05c. on Thursday, Friday, and Monday, and as high as 7.15c. was done on Brass Special. Yesterday and today, however, there seems to have been more difficulty in getting more than the even figure, and even Brass Special was sold at 7c. Galvanizers seem to be slowing up operations, and the December shipments are expected to show a sharp falling off from the November record. High-Grade continues unchanged at 9@9½c. delivered in the East, and 8¾c. in the Middle West.

One Active Day in Tin

Except for yesterday, Tuesday, the domestic tin market has been quiet during the week. On this one day probably between 500 and 600 tons was sold, most of it to consumers. Late in the afternoon prices tapered off to 66c. for prompt Straits. A sharp drop was anticipated in London, but cabled prices were unchanged today in the foreign market, and domestic prices are a little firmer. February Straits is quoted at 66¼c. and March at 65¾c.

Daily Prices of Metals

Dec.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
23	13.275	65.50	67.375	7.75@7.80	7.65	7.05
24	13.275	65.25	67.00	7.75@7.80	7.65	7.00
25			Holiday			
27	13.275	65.25	67.00	7.80	7.65	7.00@7.05
28	13.20	64.50	66.25	7.80	7.60@7.65	7.00
29	13.175	64.875	66.75	7.80	7.60@7.65	6.975@7.00
Av.	13.240	65.075	66.875	7.790	7.640	7.013

Average prices for the calendar week ending Dec. 25 are: copper, 13.315c.; 99 per cent tin, 65.925c.; Straits, 67,650c.; N. Y. lead, 7.790c.; St. L. lead, 7.650c.; zinc, 7.020c.; and silver, 53.350c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
23	56¾	57½	64¼	302¾	296½	29⅛	29 7/16	33	32 13/16
24	56¾	57½	64¼	301	295½	29	29 5/16	32⅞	32¾
27				Holiday					
28	56⅜	57¼	64¼	297¾	294	28⅞	29⅛	32 11/16	32⅝
29	56½	57⅜	63¾	297¾	294⅜	28⅞	29 1/16	32¾	32 11/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Dec.	Sterling Exchange "Checks"	Silver		Gold London	Dec.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
23	4.84¾	53½	24 11/16	84s11½d	27	4.84¾	53½	Holiday	
24	4.84⅝	53⅜	24¾	84s11½d	28	4.84¾	54	24 15/16	84s11½d
25	Holiday			.....	29	4.84¾	54	24 15/16	84s11½d
					Avg.		53.675		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Silver Up to 54c.

The silver market was generally quiet before the Christmas holidays, but subsequently India came in as a buyer, and in spite of small sales by China advanced the price to 54c. on the 28th and 29th, which level had been touched only once before in the current month. The market seems steady, but future tendency still remains uncertain.

Mexican Dollars (Old Mexican pesos): Dec. 23d, 40⅝; 24th, 40½; 25th, holiday; 27, 40⅝; 28th and 29th, 41c.

Exchanges Steady

Sterling has been somewhat stronger; francs and lire steady. Closing cable quotations on Tuesday, Dec. 28, were: francs, 3.965c.; lire, 4.51; and marks, 23.845c. Canadian dollars, ⅛ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Per lb. 99 per cent grade, 27c.; 98 per cent grade, 26½@27c. London, £105@£107 per long ton.

Antimony—Per lb., duty paid, New York: Chinese brands, January and February, 12½@13c.; Cookson's "C" grade, 17½c. Market continues quiet. Needle and oxide nominally unchanged from quotations in the Dec. 4 issue.

Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., New York, 60c. London, 1s. 10½d.@1s. 11d. for American metal; 1s. 10d. for Australian metal.

Iridium—Per oz., $120@$125 for 98 @99 per cent sponge and powder. Quiet. London, £32½ in iridio-platinum; £17@£20 for sponge and powder. Nominal.

Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton according to quantity.

Osmium—Per oz., $65@$70. London, £16@£19.

Palladium—Per oz., $63@$66. Pure metal as a constituent of crude platinum, $55@$60 per oz. Dull. London, £11@£12, nominal.

Platinum — Official price on refined metal, $112 per oz. Open market cash sales of large lots, $106. Pure metal as a constituent of crude platinum, $105. Market very dull.

London, £23 per oz. for refined and £20½ for crude. Dull.

Quicksilver—Per 75-lb. flask, $100, firm. San Francisco wires $100, steady. London, £17¼@£17¾.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Dec. 4.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c. Caucasian (washed), 53@55 per cent, 38@40c.

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, duty paid, $70@$80 per ton in carloads.

Tungsten Ore — Per unit of WO_3, N. Y.: Wolframite, $10.75@$11; Western scheelite, $11.25@$11.50. Market dull.

Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the Dec. 4 issue.

Zinc Blende Unchanged; Lead Ore Lower

Joplin, Mo., Dec. 24, 1926

Blende	
High	$50.45
Premium blende, basis 60 per cent zinc	$47.00@ 48.00
Prime Western, basis 60 per cent zinc	46.00
Fines and slimes, 60 per cent zinc	44.00@ 41.00
Average settling price, all zinc	45.50
Galena	
High	$103.00
Basis 80 per cent lead	97.50
Average settling price, all lead	102.04

Shipments for the week: Blende, 17,840; lead, 2,016 tons. Value, all ores the week, $1,017,550.

To removal of the richer ore reserves during the summer and early fall is generally credited the lower tonnage production at the close of the year. The output of zinc concentrate is now approximately 2,000 tons less than the peak summer production.

With the declining zinc production there follows a lowered output of lead. Reserve stocks of lead are now mostly disposed of, and the only zinc stock is the current week's production.

Platteville, Wis., Dec. 25, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$48.75
Lead Ore	
Lead, basis 80 per cent lead	$97.50

Shipments for the week: Blende, 1,360 tons; lead, none. Shipments for the year; Blende, 56,762; lead, 1,866 tons. Shipments for the week to separating plants, 2,387 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fuller's Earth, Fluorspar, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Pumice, Pyrites, Quartz Rock Crystals, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Dec. 4 issue.

Potash—An increase of 9½ per cent in the average price of potash, effective Dec. 23, has just been voted by the Federal Potash Council (Germany), according to Acting Commercial Attache Miller at Berlin in a cablegram to the Department of Commerce. A provision in the German law states that the prices for export cannot be less than inland prices. It is safe to assume, the Department of Commerce advises, that prices for German potash in the United States will be advanced accordingly. To date prices remain unchanged from quotations in the Dec. 4 issue.

Mineral Products

Arsenious Oxide (White Arsenic)— 3½@3¾c. per lb. Quiet. London, £16½ per long ton for 99 per cent Cornish white.

Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and **Zinc Oxide** are unchanged from prices in the Dec. 4 issue.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $100 per long ton, furnace, for delivery during first half of 1927. Imported alloy, $100, duty paid. Market active. Spiegeleisen, 19@21 per cent, $36@$37 f.o.b. furnace; 16@19 per cent, $34@$35.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium are unchanged from prices in the Dec. 4 issue.

Metal Products

Rolled Copper—Sheets, 22c.; wire, 15½c.; f.o.b. mill.

Lead Sheets—Full rolled, 11½c. per lb.; clipped, 12c.

Nickel Silver—Reduced on Dec. 28 to 19c. per lb. for 18 per cent nickel, Grade A sheets.

Yellow (Muntz) Metal—Dimension sheets, reduced on Dec. 28 to 19⅝c. per lb., and rods to 16⅝c.

Zinc Sheets—11½c. per lb., f.o.b. mill.

Refractories

Fireclay Brick, Chrome Brick, Magnesite Brick, Silica Brick and **Zirkite** are unchanged from quotations in the Dec. 4 issue.

Steel Prices Unchanged—Pig Iron and Coke More Active

Pittsburgh, Dec. 28, 1926

Demand for steel for prompt delivery has undergone little if any further diminution in the last fortnight. On the other hand, there has not arisen any large demand for extended deliveries beginning Jan. 1, as has sometimes been the case in December. Thus the promise for the new year, derived purely from market circumstances, is not particularly good. The long-range view, taking cognizance of the persistence of heavy consumption, presents next year in a favorable aspect.

Pig Iron—The Standard Sanitary Manufacturing Co. has bought 20,000 tons of pig iron to complete first-half requirements of its Allegheny and New Brighton plants, at $18.50, Valley, for No. 2 foundry, the previous market, merely a small lot market, having been $19. It also bought 18,000 tons of southern Ohio iron for the Louisville plant, at $21.90 delivered. Bessemer, $20; basic, $18.50; foundry, $18.50@$19, f.o.b. Valley furnaces.

Connellsville Coke—A little contracting has been done at about $4 for first-quarter furnace coke. It seems unlikely that wages in the Connellsville region will be reduced. Spot furnace, $3.50; spot foundry, $4.75@$5.25.

Mining Stocks—Week Ended December 25, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	49⅛	48¼	49	Oc.16, No.22	Q 0.75
Arcadian Consol.	Boston	*75	*45	*45		
Ariz. Com'l	Boston	9⅜	9⅛	9⅛	Jy. 16, Jy. 30	0.50
Calaveras	N. Y. Curb	....	....	1½		
Calumet & Arizona	New York	68½	68	68	De. 3, De. 20	Q 1.50
Calumet & Hecla	Boston	157½	154	154	No.30, De.15	0.50
Cerro de Pasco	New York	63⅜	62⅜	63¼	De.16,De.23,X	1.00
Chile Copper	New York	35¼	34⅜	34⅜	De.1,De.27, Q	0.62½
Chino	New York	...	...	25⅛		
Con. Coppermines	N. Y. Curb	3	2⅞	3		
Copper Range	Boston	15⅛	14	14	May, 1925	1.00
Crystal Copper	Boston Curb	*32	*29	*30		
East Butte	Boston	2⅜	2⅛	2⅜	Dec., 1919	0.50
First National	Boston Curb	...	...	*5	Feb., 1919	0.15
Franklin	Boston	...	...	*30		
Granby Consol	New York	35⅜	33¾	33⅞	May, 1919	1.25
Greene-Cananea	New York	33	30½	33	Nov., 1920	0.50
Hancock	Boston	*50	*27	*37		
Howe Sound	New York	41	40¼	40⅞	Oc.1, Oc.15	Q 1.00
Inspiration Consl.	New York	26⅛	25⅛	25⅞	De.16, Ja.3,	Q 0.50
Iron Cap	Boston Curb	4¼	2⅞	2⅞		
Isle Royale	Boston	11	10	10	No. 30, De. 15	0.50
Jerome Verde Dev.	N. Y. Curb	...	...	*30		
Kennecott	New York	63⅜	62⅜	62⅞	De. 3, Ja. 2	Q 1.25
Lake Copper	Boston	1	1	1	June, 1925	0.50
Magma Copper	New York	36⅛	35⅜	35⅜	Dec. 1, Ja. 15,	Q 0.75
Mason Valley	N. Y. Curb	2⅜	2⅜	2⅜		
Mass Consolidated	Boston	*35	*25	*35	Nov., 1917	1.00
Miami Copper	New York	16½	16¼	16⅜	No.1, No. 15	Q 0.37½
Mohawk	Boston	40	40	40	Oc.30, De 1	Q 2.00
Mother Lode Coa.	New York	4⅜	4¼	4⅜	De.10,De.31	SA 0.37½
Nevada Consol	New York	15⅜	15	15	De.15, De.31	Q 0.37½
New Cornelia	Boston	22⅜	22	22	No.5, No.22	Q 0.50
Noranda	N. Y. Curb	24¼	23	23⅜		
North Butte	Boston	3½	3½	3⅜	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*48	*48	*48	Se. 1, Se. 15	0.05
Old Dominion	Boston	14½	14½	14½	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†133	†129	...	De.24, Ja.3	Q 1.50
Quincy	Boston	17	16⅜	17	Mar., 1926	1.00
Ray Consolidated	New York	15⅜	15⅜	15⅜	Ap.20, Ap.30	0.25
Ray Hercules	N. Y. Curb	...	...	16⅜		
St. Mary's Min. Ld.	Boston	26½	25⅜	25⅜	Ap.17, My.18	2.00
Seneca Copper	New York	3¼	3	3		
Shannon	Boston	*25	*15	*15	Nov., 1917	0.25
Shattuck-Denn	Boston Curb	5⅜	5⅛	5⅛		
Superior & Boston	Boston	*30	*30	*30		
Tenn. C. & C.	New York	11	10⅞	10⅞	No.30, De.15,	Q 0.25
United Verde Ex.	N. Y. Curb	24⅛	24	24⅛	Ja. 6, Fe. 1	0.75
Utah Copper	New York	...	...	111	De.15,De.31	Q 1.50
Utah Metal & T.	Boston	1½	1 1/16	1 1/16	Dec., 1917	0.30
Victoria	Boston	*75	*75	*75		
Walker Mining	Salt Lake	*79	*74	*75		
NICKEL-COPPER						
Internat. Nickel	New York	38½	37⅞	37⅞	De.16, De.31,	Q 0.50
Internat. Nickel, pfd.	New York	...	...	103⅛	Oc. 14, No.1,	1.50
LEAD						
Gladstone Mtn.	Spokane	*29¾	*29½	*29⅜	Dec. 10, 1926	0.005
National Lead	New York	180	171¾	173¾	De.10, De 31	Q 2.00
National Lead pfd.	New York	119	118	119	No.19,De.15	Q 1.75
St. Joseph Lead	New York	42	40⅞	41	Ma.10, 21	XQ 0.75
ZINC						
Am. Z. L. & S.	New York	9	8⅛	8⅛	May., 1917	1.00
Am. Z. L. & S, pfd.	New York	48⅛	46⅛	46⅜	Nov., 1920	1.50
Butte C. & Z.	New York	4⅛	4	4⅛	De.9, De.24	0.50
Butte & Superior	New York	11	11	11	De.9, De.24	Q 0.50
Callahan Zn-Ld	New York	1⅜	1⅛	1⅛	Dec., 1920	0.50
Eagle-Picher	Cincinnati	....	....	28	No.15, De.1	Q 0.40
Eagle-Picher, pfd.	Cincinnati	....	....	100	Se. 30, Oc. 5	Q 1.50
New Jersey Zn.	N. Y. Curb	188	185½	187½	No.20, De.10	X 2.00
United Zinc	N. Y. Curb	*50	*50	*50		
Yellow Pine	Los Angeles	*19	*15	*19	Dec. 1925	Q 0.04
GOLD						
Alaska Juneau	New York	1⅜	1⅛	1⅛		
Argonaut	Toronto	*56	*52	*54		
Barry-Hollinger	Toronto	*86	*82½	*82½		
Carson Hill	Boston	*20	*15	*15		
Consol. W. Dome L.	Toronto	*21⅛	*15	*18⅜		
Cresson Consol. G.	N. Y. Curb	2⅝	2⅜	2⅜	De.31, Ja.10	Q 0.10
Crown Reserve	Toronto	*10	*9	*9½	Jan., 1917	0.05
Dome Mines	New York	12⅛	11⅛	11⅛	De.31, Ja.20,	Q 0.50
Golden Center	N. Y. Curb	1⅜	1⅛	1⅛		
Golden Cycle	Colo Spring	....	....	1.74	No.30, De.10	Q 0.04
Hollinger Consol.	Toronto	19.75	19.65	19.70	De.13, De.31	F 0.10
Homestake Mining	New York	....	....	62½	De.20, De.27	M 0.50
Kirkland Lake	Toronto	*74	*71	*71½		
Lake Shore	Toronto	15.05	14.30	14.45	De.2, De.15	X 0.20
McIntyre-Porcupine	New York	26	25⅜	25⅜	No.1, De.1	Q 0.25
Newray	Toronto	*35	*33	*33		
Night Hawk Pen.	Toronto	*10	*7½	*8½		
Portland	N. Y. Curb	....	....	43	Ja.6, Ja.15, '27	0.02
Rand Mines	New York	39½	39⅜	39⅜	Au.23-30	Am.Sh. 1.52
Teck-Hughes	Toronto	5.25	4.98	5.20	Jy. 15, Au. 2	0.05
Tom Reed	Los Angeles	*52½	*45	*45	Dec., 1926	0.02
Tough-Oakes	Toronto	*56½	*50	*54		
United Eastern	N. Y. Curb	*52	*50	*50	July, 1924	0.05
Vipond Cons.	Toronto	1.68	1.61	1.65		
Wright-Hargreaves	Toronto	9.75	8.80	9.75	Ja.15, Fe.1	QX 0.15
Yukon-Alaska Trust	N. Y. Curb	20¼	20¼	20¼		
GOLD AND SILVER						
Carnegie Metals	Boston	...	...	11⅜		
Con. Cortez	N. Y. Curb	*8	*5½	*7		
Con. Virginia	San Francisco	*5⅜	*5⅜	*5⅜		
Continental Mines	N. Y. Curb	...	...	*10		
Dolores Esperanza	N. Y. Curb	*55	*37	*50	July, 1923	0.05
Premier Gold	N. Y. Curb	1⅞	1 1/16	1 1/16	De.17, Ja.4	Q 0.08
Tonopah Belmont	N. Y. Curb	2⅜	2⅜	2⅜	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	*24	*20	*20	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	3⅜	3¼	3⅜	Se.30, Oc.27	SA 0.07½
Unity Gold	N. Y. Curb	....	....	*30		
West End Consol.	N. Y. Curb	*9	*8	*8	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*40	*40	*40	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	...	...	1	Oct., 1920	0.50
Beaver Consol	Toronto	*55	*54	*55	May. 1920	0.03
Canadian Lorrain	Toronto	*60	*58	*59		
Castle-Trethewey	Toronto	1.10	1.07	1.09		
Comagas	Toronto	4.50	4.40	4.40	May, 1924	0.12½
Keeley	Toronto	1.55	1.51	1.54	Se. 1, Se.15	SA 0.12
Kerr Lake	N. Y. Curb	*82	*75	*75	Oc. 1, Oc.15	SA 0.12½
La Rose	Toronto	*17	*13	*15½	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	...	...	*55	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*14	*12	*14	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.50	3.10	3.23	De.30, Ja.15	0.12½
Nipissing	N. Y. Curb	9	8	9	De.31, Ja.20	Q 0.15
Temiskaming	Toronto	...	...	*7⅛	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	5⅛	4¼	5⅛	De.18, Ja.5,	QX 0.15
Alta Merger	Salt Lake	†*4	†*2	...		
Bingham Mines	Boston	32	29½	30	De.30, Ja.5	Q 1.00
Cardiff M. & M.	Salt Lake	*23	*23	*23	Nov., 1924	0.10
Chief Consol.	Salt Lake	3.00	2.87½	2.90	Oc.10, No.1	Q 0.10
Consti'n Mng.&Mill'g	Spokane	*52	*50	*50		
Emma Silver	Salt Lake	†1½	†1	...		
Eucpcion	Boston Curb	1⅜	1⅛	1⅛	De.18, Ja.3,	Q 0.10
Federal M. & S.	New York	93	93	93		
Federal M. & S., pfd.	New York	77	76	77	No.24, De.15	Q 1.75
Hewthorne Mines	N. Y. Curb	*12	*10	*12		
Hicla Mining	N. Y. Curb	*16	*15½	*15½	No.15, De.15	Q 0.50
Highland-Surprise	Spokane	*18½	*16½	*17		
Iron King Mining	Salt Lake	*20	*20	*20		
Keystone Mining	Salt Lake	...	...	*30	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*15¾	*15	*15¾		
Lucky Tiger-Com.	Kansas City	†6.50	†6.15	...	Dec. 20, 1926	0.12
Mammoth Mining	Salt Lake	....	....	2.65	Apr. 1, 1926	0.10
Marsh Mines	Spokane	1⅞	1⅜	1⅞	Se.15, Oc.19	0.15
Park Utah	New York	5.90	5.75	5.90	De.15, Ja.2	Q 0.15
Plutus Mining	Salt Lake	2.15	2.15	2.15	Oct. 15,	Q 0.15
Prince Cons.	Salt Lake	*2	*2	*2		
Silver King Coal	Salt Lake	7.70	7.45	7.70	De. 16, Ja.3,	0.25
Silversmith	Spokane	*25⅜	*25	*25⅜	Oc.1, Oc.10	Q 0.02
Strattons Mines	Spokane	*33⅛	*32	*32		
Sunshine M. Co.	Spokane	*37¼	*36	*37		
Tamarack-Custer	Spokane	*41	*38⅜	*38⅜	Sept., 1924	0.25
Tintic Standard	Salt Lake	11.00	10.25	11.00	De.11, Ja.3	0.30
Utah-Apex	Boston	5 1/16	5	5⅛	Oc.3, Oc.15	Q 0.25
Western Utah Copper	N. Y. Curb	....	....	*5		
IRON						
Bethlehem Steel	New York	48⅜	47⅛	48	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	80	70	76	Oct., 1926	1.00
Colorado Fuel & Iron	New York	45⅜	44⅞	45⅞	May, 1921	0.75
Gt. North'n Iron Ore	New York	20⅛	18⅜	20	Dec.6, Dec.28	0.75
Inland Steel	New York	43⅜	42	43	No.15, De.1	Q 0.62½
Mesabi Iron	N. Y. Curb	97	95	95		
Replogle Steel	New York	11⅝	11	11⅜		
Republic I. & S.	New York	57⅜	56⅛	57	No.15, De.1	Q 1.00
Republic I. & S. pfd.	New York	96¾	96⅛	96⅛	De.15, Ja.2	Q 1.75
Sloss-Sheffield S. & I.	New York	131	128⅜	130⅛	De.10, De.20	Q 1.50
Sloss-Shef. S.&I. pfd.	New York	....	....	107	De.20, Ja.3	Q 1.75
U. S. Steel	New York	159¼	156⅜	159⅛	De.1, De.30	Q 1.75
U. S. Steel pfd	New York	116⅞	114⅛	116⅞	No.2, No.29,	Q 1.75
Virginia I. C. & C.	New York	...	...	50	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	..	..	85	De.15, Ja.2,	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	...	...	33⅛	Ju.16, Ju.17	1.70
So. Am. Gold & P.	N. Y. Curb	3¾	3⅜	3¾		
Alum.Co.of Amer.	N.Y.Curb	72⅜	72⅛	72⅛		
Alum. Co. of Amer pf.	N.Y.Curb	102¼	102¼	102⅛	De.15, Ja.15	Q 1.50
Vanadium Corp.	New York	39⅜	39	39⅛	De.1, De.15,	X 1.00
Patino M. & E.	N. Y. Curb	26⅛	25⅜	25⅞	Nov. 5, 1926	5 sh
ASBESTOS						
Asbestos Corp., New	Montreal	24¼	23⅛	24	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	86	85	85⅛	De 31, Ja.15,	Q 1.75
SULPHUR						
Freeport Texas	New York	35⅛	31⅞	35⅛	Ja.15, Fe.1	Q 0.50
Texas Gulf, new	New York	50⅜	46⅜	50⅛	De.1, De.15,	Q 1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	44⅜	42⅛	42⅛	No.19, De. 1,	Q 1.00
Amer. Metal pfd	New York	....	....	113¼	No.20, De.1	Q 1.75
Amer. Sm. & Ref.	New York	148⅛	143⅛	147⅞	Oc.15, No.1,	Q 2.00
Amer. Sm.&Ref.pfd.	New York	122⅜	121⅛	121⅜	No.5, De.1,	Q 1.75
Consol. M. & S.	N. Y. Curb	....	....	300	De.31, Ja.15	X 6.25
Federated Metals	N. Y. Curb	...	...	12⅜		
Newmont Mining	N. Y. Curb	73	73	73	De.31, Ja.17,	0.60
Southwest Metals	N. Y. Curb	*10	*10	*10		
U. S. Sm. R. & M.	New York	36⅜	35⅛	35⅛	Oc.7, Oc.15,	Q 0.87½
U. S. Sm. R.&M.pfd.	New York	46½	46⅛	46⅛	Oc.7, Oc.15,	Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

LONDON QUOTATIONS—WEEK ENDED DEC., 14 1926

Name	High	Low	Last	Date	Amount	Last Divd
Aramayo Mines (25 frs.)	75/—	72/6	75/—	Aug. 1926	15 p.c.†	
British Platinum (£1)	3/4½	3/6	3/3	Feb. 1925	2½ p.c.	
Burma Corpn. (10 rupees)	14/4½	14/—	14/3	Dec. 1926	6 annas*	
Bwana M'Kubwa (5s)	7/1½	6/9	7/—			
Camp Bird (2s)	2/6	2/3	2/3			
El Ore (£1)	5/3	4/10½	5/—	Nov. 1924	2½ p.c.*	
Esperansa (10s)	—/6	—/3	—/3			
Frontino & Bolivia (£1)	11/—	8/9	10/—	Jan. 1927	5 p.c.	
Mexican Corpn. (£1)	8/6—	7/9—	8/3			
Mexico Mines of El Oro (£1)	20/9	19/—	20/9	Dec. 1926	3¾ p.c.*	
N'Changa Copper Mining	15/3	14/4½	14/4½			
Oroville Dredging (£1)	4/3	3/1½	4/3	Dec. 1923	3¾ p.c.	
Ouro Preto (£1)	2/4½	2/1½	2/1½	May 1925	2½ p.c.	
Rhodesian Congo Border (£1)	82/6	72/6	80/—			
St. John del Rey (£1)	9/3	8/10½	9/—	June 1925	6½ p.c.	
San Francisco Mines (10s)	31/10½	31/1½	31/6	June 1926	15 p.c.	
Santa Gertrudis (£1)	14/10½	14/4½	14/6	Jan. 1927	3¾ p.c.	
Selukwe (2s. 6d.)	11/6	11/—	11/6	April 1917	6¾ p.c.	
S. Amer. Copper (2s.)	3/6	3/3	3/6	Nov. 1917	75 p.c.	
Tanganyika (£1)	45/3	41/3	42/6	Aug. 1926	7½ p.c.	
Tomboy (£1)	3/6	3/—	3/6	July 1926	10 p.c.	
Union Miniere du Haut-Katanga (Brussels)	8.200	8.050	8.125	July 1926	170 (‡)	

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation